Front End Evaluation Research Results

Communications and Concept Planning

Hatfield Marine Science Center

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EXECUTIVE SUMMARY

Science Learning, inc. (SLi) was engaged by Aldrich/Pears Associates on behalf of the Hatfield Marine Science Center (HMSC) to undertake an evaluation for the renovation of the existing visitor center. This study occurs in conjunction with the Communications Planning Phase of the project. The purpose of the study is to provide insight into visitors' preconceptions, attitudes, and levels of knowledge with regards to a variety of marine science subjects and the institution itself.

During the Communications Planning Phase workshop, April 15, 1994 in Vancouver, B.C., a document entitled Hatfield Marine Science Center: Draft Thematic Approach was presented and discussed. In the evaluation study, visitors' reaction to the major concepts contained in this document were investigated, specifically: "Searching for Patterns in a Complex World"; "The Scientific Method"; Scales of Scientific Research (i.e., global, "bird's eye," eye level, and microscopic); and, issue areas associated with each of the scales of research (i.e., global warming, ozone depletion, ecosystems, biodiversity, endangered species, fisheries, oil spills, and habitat loss). Some secondary concepts were also investigated, including: scientific tools and equipment, and research questions, consequences, and applications.

SLi collected data from 140 visitors to the Hatfield Marine Science Center; both a questionnaire (N = 80) and face to face, semi-structured interviews (N = 60) were utilized. Data was collected for three and a half days, from April 28 through May 1, 1994.

Major results were as follows:

Reasons for Attending the HMSC: Over half of the sample described having come to the Center in order to "see the exhibits and displays," and to "do something fun."

Visitors Expectations: Over half of the sample indicated that they came to learn more about marine life. No visitors claimed to have expected to encounter anything about "research" or "science" per se.

Visitors' Knowledge of General Science and of Marine Life and Environments: Over half of the sample described their knowledge of both general science and marine life and environments as being moderate.

Visitors' Level of Interest and Attitudes Toward Exhibit Themes, Media, and Topics: The "Consequences and Use of Research" was the most interesting to visitors, followed by "How to Search for Patterns in Complexity" and then "The Scientific Method".

Visitors expressed strong interest in live animal displays and

hands-on exhibits. Visitors were wary about a complete research orientation to exhibits.

Issue Areas of Greatest Interest: "Nearshore & Coastal Habitats" (83%; "Deep Ocean Habitats" (83%) and "Managing Natural Resources (73%).

Research Areas of Greatest Interest: "Environmental/ Conservation"; "Animal-Related Research" and "Oregon Coastal Issues."

For most visitors, the HMSC was perceived as part of their visit to the Oregon Coast. Visitors to the HMSC had a strong orientation toward seeing and closely interacting with marine life and environments. Regardless of their background knowledge of science, most visitors attended the HMSC in order to do something fun and interesting. Attending the HMSC was an extension of seeing and exploring real Oregon coastal environments. Thus, visitors tended to judge potential presentations of research exhibits in terms of their relationship to marine life and environments.

The more receptive visitors were to "research" as a concept, the more positive they were toward the four scales of research. Visitors who were positive and those who were negative towards the four scales of research were essentially responding to the same issue but from different angles. Specifically, visitors valued presentations which will give visual and tangible representations of what is normally not accessible. How visitors varied was in their judgements regarding whether the various scales and corresponding issue areas were amenable to tangible, concrete representation.

In conclusion, we recommend an approach that starts with real things found in the world, in particular the Oregon coast; things that would be intrinsically interesting to visitors. These presentations can then be augmented with discussions about the nature of the scientific inquiry being undertaken to understand these real things. In this way, both the visitor's agenda and the HMSC's agenda can be accommodated.

PROJECT OVERVIEW

Science Learning, inc. (SLi) was engaged by Aldrich/Pears Associates on behalf of the Hatfield Marine Science Center (HMSC) to undertake an evaluation for the renovation of the existing visitor center. This study occurs in conjunction with the Communications Planning Phase of the project, the outcome of which will be the development of a communications plan and the selection of concepts for visitors' interpretive experience. The purpose of the study is to provide insight into visitors' preconceptions, attitudes, and levels of knowledge with regards to a variety of marine science subjects and the institution itself. Results presented can serve as an empirical basis for general discussions of exhibit content, media, and approaches, as well as prioritization of the messages selected for the future visitor center.

During the Communications Planning Phase workshop, April 15, 1994 in Vancouver, B.C., a document entitled Hatfield Marine Science Center: Draft Thematic Approach was presented and discussed (see Appendix A). In the evaluation study, visitors' reaction to the major concepts contained in this document were investigated, specifically: "Searching for Patterns in a Complex World"; "The Scientific Method"; Scales of Scientific Research (i.e., global, "bird's eye," eye level, and microscopic); and, issue areas associated with each of the scales of research (i.e., global warming, ozone depletion, ecosystems, biodiversity, endangered species, fisheries, oil spills, and habitat loss). Some secondary concepts were also investigated, including: scientific tools and equipment, and research questions, consequences, and applications.

On Thursday April 28, 1994 after arriving at the HMSC, Dana Holland of SLi met with the director and various staff at HMSC before beginning data collection. These discussions were useful in further familiarizing SLi with the institution and with issues of concern to the HMSC. SLi received a summary of the Meeting of Design Advisory Committee, dated September 8, 1993 (see Appendix B). Visitors' attitudes toward several fields of marine research described in the document were investigated, specifically: aquaculture and fisheries; deep ocean habitats; nearshore and coastal habitats; and, forest resources and water.[1]

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[1] The specific topics selected were intended to complement and provide contrast with other concepts being tested. Topics that were not selected were deemed either not central to the purposes of the current research or were too complicated to usefully test on the questionnaire.

The following report examines visitors' perspectives, interests, and assumptions about the HMSC as an institution and about scientific research as the focus of the future visitor center. The results also provide insight into contextual issues regarding: the nature of visitors' current experiences at the HMSC; visitors' motivations for attending the Center; the current information and exhibits that resonate most strongly with visitors; and, the ways in which visitors' experiences at the Center connect with other personal interests and agendas. Information described here can serve as a useful "reality check" in the development of the Communications Plan, and in addition, can guide decisions regarding needs for and parameters of continued visitor input into the visitor center renovation process.

METHODS

SLi undertook two distinct research strategies in executing this study: a Hatfield Marine Science Center Questionnaire was developed and administered, and face to face, semi-structured interviews were conducted. The two strategies were complementary. The questionnaire provided a little information about a lot of topics, and the interview provided in-depth information about comparatively fewer topics. Data was collected for three and a half days, from April 28 through May 1, 1994. SLi would like to acknowledge and thank Jan Auyong for her help in organizing this study, and Mike Murphy for assisting in collecting data.

The HMSC Questionnaire was developed to provide information about visitors' attitudes toward and knowledge of the various concepts and themes elaborated above. A copy of the HMSC Questionnaire is included as Appendix C. Rather than quiz visitors about the details and content of their prior knowledge, visitors were asked on question #5 to assess their own knowledge of both general science and marine life and environments. Previous studies undertaken by SLi have shown that even without formal, academic study, people can gain considerable knowledge, appreciation, and insight into a given subject through informal recreational and avocational pursuits.

On question #6 of the HMSC Questionnaire, visitors were asked to rate their interest in twenty-two items. These ratings ostensibly measured level of interest, however the responses reflect visitors' implicit attitudes towards the topics.[2] The items included exhibit themes, display media, research scales, issue areas relevant to research, and several research fields. The data allowed for comparisons to be made between items, such as: do visitors respond similarly to issues (e.g., pollution, marine habitat loss, etc.) as they do to the research scale relevant to that issue (e.g., research on a regional, "bird's eye" scale)? In addition to correlations across items, these

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[2] It is not effective in this type of research to ask visitors directly "what is your attitude about 'x'." Indirect means are most revealing. For instance in interviews, peoples' attitudes are often most apparent in the ways they deal with a subject (e.g., facial expression, tone of voice, extent of elaboration, etc.) rather than strictly as indicated by the content of what they say. In questionnaires it is odd to ask "what is you attitude about 'x'." A more natural ways to obtain the same information is to ask "what do you think about 'x'" or "are you interested in knowing about 'x'." In questionnaire data analysis for this study we assume that there is symmetry between visitors' "level of interest" and "attitudes."

items were correlated with other variables, such as self-reported knowledge and social group.

A total of 80 questionnaires were completed over three, half day periods. Only one questionnaire was given to each visitor group. The sample was randomly selected, although rather than approach every "Nth" group, we approached every group possible during data collection periods. Initially, visitors were asked to complete the questionnaire as they exited the HMSC. Due to a high refusal rate (6 refused out of 15 approaches) we distributed the remainder of questionnaires to visitors in the aquarium tanks area. This resulted in a much reduced refusal rate (6 refused out of 77 approaches). After agreeing to fill-out the questionnaire, visitors took it with them and completed it at a convenient time during their visit. The researcher recorded demographic information about the visitor and their group, noting gender, social group, age, and ethnicity.

The second research strategy undertaken during this study was semi-structured interviewing. A total of 60 interviews were conducted with visitors at the end of their visit to the HMSC. When the interviewee did not object, the interviews were tape recorded. Since the setting for the study was the HMSC itself and the occasion was peoples' visit, we should note that the study was naturalistic, rather than experimental research.

Interviews during this study were conducted to be more like conversations rather than quizzes or interrogations. SLi's experience in numerous studies has shown that a more conversational, informal approach to interviewing is more effective in eliciting visitors' attitudes and preconceptions. In interviews we attempt to reduce or eliminate visitors' impression that they are being probed or tested. In our interviews, visitors have a great deal of control over the tenor and content of the talk. Since the "conversation" is mutual, they are given the opportunity to tell us what they think rather than merely respond to our imposed stimulus. Some visitors need prompting in order to address the basic interview questions; other visitors have more to say than is required. Our interviewing approach enables us to obtain useful and valid data from all types of visitors.

The protocol for the interviews was to approach an adult visitor, explain the reason for the interview, and ask if they would answer a few questions.[3] Most visitors were very willing

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[3] In discussions regarding target audiences for the future visitor center held prior to the commencement of this study, it was determined that adults will be the primary audience. For that reason during this study we included only adults in the sample. This did not mean however that we did not note adults' comments

to participate. A total of 60 interviews were conducted over three and a half days; four visitor groups declined to be interviewed. Interview questions were:

1) Was there a particular reason you were interested in coming to the Hatfield Marine Science Center today?

2) Have you been to the Center before? How often do you come? May I ask where you are from?

3) What did you particularly like seeing or learning about when you were going through the Center? What did you like best?

4) Before coming today did you know that in addition to the exhibits and displays that you've just seen that the Hatfield Marine Science Center is also a major research institution?

5) We are currently planning to change the exhibits and displays, from natural history presentations and descriptions to more of a focus on the research conducted by scientists here. Would this be of interest to you? What specific topics would be interesting to you?

6) How much would you say you know about science and marine life?

7) Another thing we are considering is organizing all the future displays in terms of the four scales in which research goes on -- the global scale, the regional or "bird's eye" scale, the local scale of what we'd see with our eyes if we were to go out someplace, and the microscopic scale. Does this sound interesting? How so, or how does it not?

In addition to the questions listed above, when visitors introduced other relevant topics, SLi continued the discussion in terms consistent with current plans and issues related to the renovation project. For each interview, SLi noted the gender, age, ethnicity, social group, and general demeanor of the visitor. Typically, one visitor per group was interviewed, although occasionally other group members offered opinions or elaborated on an issue. Parents occasionally deferred to their children, particularly with reference to what they had enjoyed seeing and doing. When this occurred, we listened to the child's response, then confirmed its validity with the adult.

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about children.

RESULTS

Questionnaire Results

Demography of Sample: A total of 80 questionnaires were completed, most (90%) on weekend days. The majority of visitors were in adult groups. The social group[4] distribution of the sample was:

65%	Lone Adult/Adult Group/Couple
31%	Families
4%	School Groups

Ages of adults in the sample were evenly distributed:

33%	18-30 years
36%	31-45 years
22%	46-60 years
9%	> 60 years

About half of the children in visitor groups were under the age of 8 (with nearly half of these under 5), and half were 9 or older. Most groups (60%) contained both males and females. All visitors in the sample were Caucasian.

One third of the sample were first time visitors to the HMSC. Slightly more than one third had come to the Center once or twice previously, and the remainder described visiting the Center 1-2 times per year (11%) and 3 or more times per year (16%). Slightly more than one third of the sample planned to see or had already seen the Oregon Coast Aquarium on that particular day.

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[4] Based on numerous projects undertaken in diverse institutions in the U.S., SLi has developed a protocol for making observational social group designations. The primary factor in making social group determinations is whether the group includes a person 17 years old or younger. "Families" are defined as inter-generational groups including at least one member aged 17 or younger. "All adult groups" and "couples" may actually be related individuals, but for research purposes, they are considered to be all adult groups. "School groups" are defined as groups of children, under the age of 18, accompanied by teachers and/or chaperons. "All kid groups" (of which there were none in this sample) are groups of children unaccompanied by an adult.

The home residence of nearly three-quarters of the sample was the state of Oregon. The distribution was:

10%	Lincoln County
24%	Corvaillas/Lane, Benton, Linn, Marlon, and Polk Counties
38%	Portland area/Other parts of Oregon
14%	Northwestern U.S./British Columbia
10%	Other states in the U.S.
2%	Foreign

Figure 1 shows that visitors who lived in Lincoln County or the five nearby counties were most likely to be frequent HMSC visitors. Those from the Portland area and other parts of Oregon were equally first time and occasional HMSC visitors. Most of those from outside of Oregon were first time visitors.

Reasons for Attending the HMSC: Over half of the sample described having come to the Center in order to "see the exhibits and displays," and to "do something fun." Allowing for multiple responses, the overall distribution was:

65%	See exhibits and displays
58%	Do something fun
50%	Check it out/see the HMSC generally
15%	Interested in a particular topic
13%	Other
11%	Bring my children
3%	Came for Quake Fair

It should be noted that the final two response categories above were not offered as selections on the questionnaire, but were responses often given by visitors. Figure 2 shows that there were no differences in visitors reasons for visiting the HMSC as a function of social group, except for families intention to bring children.

Half of the sample specified their reasons for coming to the Center. These non-directed elaborations were (N=40):

50%	Fish displays/tanks
28%	All Displays
28%	Octopus
25%	Tidal Pool
8%	Whale Exhibit
5%	Shore Birds

Visitors Expectations: Although, expectations were not a major focus of this research, it was potentially useful to ask visitors to reflect on what they had expected to see and do at the HMSC. No visitors claimed to have expected to encounter anything about "research" or "science" per se. The majority of the sample (80%)

provided a response, and allowing for multiple responses, the distribution was:

52% Marine Life
34% Exhibits Generally
22% Tanks/Natural Environments
19% To Learn
6% Other
3% More Displays/Different Displays

Although there were no differences in visitors' responses as a function of social group, there was a tendency for young adults to mention "learning" as an expectation (Figure 3).

Most visitors claimed that they were aware of the research purpose of the HMSC. The distribution of responses was:

71% Knew the HMSC was a research facility
23% Did not know
6% Unsure

There were no differences in visitors' responses with regards to reasons for attending the HMSC or social group. Previous visitation correlated with accurate awareness of the purpose of the HMSC (Figure 4). This was likely related to home residence which was also a factor that affected awareness of the purpose of the HMSC. Those living in closer proximity to the HMSC were more likely than others to be aware of the research purpose of the facility (Figure 5).

Visitors' Research Interests: Visitors were asked in an open-ended question to describe specific interests they have in research conducted at the HMSC. Slightly more than half the sample provided responses. Of these, about half were interested to know what were the projects. Other interests included: information relevant to environmental and conservation issues; the process of how science is done; applications and purposes of the research; and research about a particular animal. Interview results presented in the following section more fully describe visitors' research interests.

Visitors' Knowledge of General Science and of Marine Life and Environments: Over half of the sample described their knowledge of both general science and marine life and environments as being moderate. The distribution of visitors' knowledge of general science was:

20% A lot/High
51% Moderate
29% A little/Low

The distribution of visitors' knowledge of marine life and environments was:

14% A lot/High
56% Moderate
30% A little/Low

Figure 6 shows that visitors' knowledge of science and of marine life was highly correlated. Figures 7 and 8 show visitor knowledge of general science and marine life as a function of social group. More visitors in all adult groups claimed to have had high background knowledge compared to family groups. Home residence was a factor affecting both the extent of visitors' prior knowledge and the nature of that knowledge. Figures 9 and 10 show that visitors from Lincoln County had higher knowledge of marine life and environment than they did of general science. The opposite was true for those from outside the local six county region. These visitors claimed to have more knowledge of general science than marine life. Visitors with higher background knowledge in science were most likely to give as a reason for coming to the HMSC "to do something fun" or "check it out generally"; whereas those with little background knowledge were slightly more likely to indicate an interest in displays and particular topics (Figure 11).

Most of the sample (80%) gave an explanation for how they had gained their knowledge and experience of science and marine life. Half of the visitors responded that they had knowledge of science and marine life from formal education, with 30% mentioning college study, and 19% mentioning "school" or "schooling." Informal avocational and recreational means by which visitors had gained knowledge of science and marine life were: reading (23%), observing and visiting the coast (21%); visiting aquaria and museums (16%); watching television (11%); professional (5%); and recreational pursuits (4%).

Those with formal, academic training tended to rate their knowledge of both science and marine life as being higher than other visitors (Figures 12 and 13). Observation of and visits to the coast were frequently associated with self-reported "moderate" levels of knowledge. Figure 14 describes how visitors acquired their background knowledge as a function of their home residence. Local residents were more likely to gain knowledge through first-hand experiences at the coast or by visiting aquaria and museums; whereas those from outside the local area more frequently mentioned college study.

Visitors' Level of Interest and Attitudes Toward Exhibit Themes, Media, and Topics:

The following section describes the results pertaining to visitors' attitudes toward topics and themes being considered for inclusion in the renovated visitor center. Figure 15 describes visitors' expressed level of interest in: "Learning about The Scientific Method"; "How to Search for Patterns in Complexity";

and "The Consequences and Uses of Research." The "Consequences and Use of Research" was highly provocative to visitors, with nearly three quarters of the sample (71%) expressing more than moderate interest.[5] For "How to Search for Patterns in Complexity" 48% of the sample, and for "...The Scientific Method" 37% of the sample respectively expressed more than moderate interest.

There were no differences in visitors' attitudes toward "...Patterns in Complexity" as a function of previous visitation. There were differences as a function of visitors' prior knowledge. Figures 16 shows that the more knowledgeable visitors were about science the more likely they were to express interest in "...Patterns in Complexity." Those with moderate and little background knowledge were mostly neutral or negative. Visitors in all adult groups were slightly more likely to express high or moderately high interest in "...Patterns in Complexity" than were visitors in family groups (Figure 17).

"The Consequences and Uses of Research" was equally intriguing to visitors, regardless of social group, previous visitation, or prior background in general science. There were slight differences as a function of visitors' background knowledge and experience with marine life and environment. Figure 18 shows that although all visitors expressed high interest in "The Consequences and Uses of Research," those with low knowledge of marine life were particularly interested.

For "Learning about The Scientific Method" there were differences in visitors' responses as a function of social group and prior knowledge. Family groups were more likely than all adult groups to express high or moderately high interest in "...The Scientific Method" (Figure 19). Visitors with low prior knowledge of general science and marine life were more likely than others to express interest in "...The Scientific Method." Visitors with high background knowledge were neutral or negative (Figures 20 and 21).

Figure 22 describes visitors' expressed levels of interest in various exhibit media. Visitors were nearly unanimous in their desire to see live animal displays, with 96% of the sample expressing more than moderate interest; no visitors responded with little or no interest. There were no differences in visitors' interest in live animal displays as a function of previous visitation or background knowledge. There were some differences as a function of social group; family groups were unified in their enthusiastic responses (Figure 23).

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[5] "More than moderately interested" was determined by adding the percentages of all visitors who responded 4 or 5 on the 5-level scale, with 1 being "no interest" and 5 being "very interested."

After live animal displays, the availability of hands-on exhibits was the next most valued exhibit media, with 77% of the sample responding with more than moderate interest. There were no differences in visitors' interest in hands-on exhibits as a function of previous visitation or prior knowledge. There were differences as a function of social group (Figure 24). Families, as a group, experessed strong interest in hands-on exhibits.

Visitors were equally satisfied at the prospects of meeting a scientist in person or watching a video of a scientist at work. Overall, nearly two-thirds of the sample responded that they were more than moderately interested in either meeting a marine scientist (62%) or watching a video (62%). There were no differences in visitors' responses as a function of previous visitation, social group, prior knowledge, or awareness that the HMSC was a research institution.

The opportunity to use an interactive computer or to view scientific tools and equipment was comparatively less important to visitors, with 59% and 50% respectively expressing more than moderate interest. There were no differences in visitors desire to use interactive computers as a function of previous visitation, social group, or prior knowledge of general science, although the less prior knowledge of marine life visitors had, the more likely they were to express interest in interactive computers (Figure 25). There were no differences in visitors' responses regarding scientific tools and equipment as a function of social group or prior scientific knowledge.

Figure 26 describes visitors' interest in each of the four scales of scientific research. Overall visitors were positive towards the scales of research. Very few visitors had no or very little interest in the scales. The one-to-one scale, described on the questionnaire as "research on ecosystems and animals" was most uniformly intriguing to visitors with 73% expressing more than moderate interest.[6] There were no differences in visitors' responses as a function of previous visitation, home residence, social group, or prior knowledge. More than moderate interest was expressed by 65% of the sample for the regional-scale (i.e., "bird's eye" scale) of research, and by 59% for research at the global scale. There were no differences in either of these scales as a function of previous visitation, home residence, social group, or prior scientific knowledge.

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[6] It was decided that "bird's eye scale" would be too ambiguous to list as an item on the questionnaire without providing some additional elaboration. The "regional scale" was determined to be a reasonable substitution for "bird's eye scale" and was also deemed appropriate since it obviously contrasts with the three other scales.

Of the four "scales", the microscopic research scale was least intriguing to visitors with 48% expressing more than moderate interest. No differences were evident in visitors' interest in microscopic scale research as a function of home residence, previous visitation or social group; however there were differences as a function of prior knowledge (Figures 27 and 28). Visitors with high prior knowledge, particularly those with high knowledge of marine life, were less interested than others in research at a microscopic scale. This difference was in contrast to the other three scales in which there were no apparent differences bases on prior knowledge.

Figure 29 describes visitors' interest in issue areas and research examples relevant to the four scales of research. Visitors expressed the highest interest in issues and research areas which related most closely to marine environments. The following describes the proportion of visitors who expressed more than moderate interest in each topic (i.e., the percentages who responded with either 4 or 5 on the 5-level scale):

Nearshore & Coastal Habitats	83%
Deep Ocean Habitats	83%
Managing Natural Resources	73%
Habitat loss & Oil Spills	70%
Pollution & Disease	69%
Biodiversity & Endangered Species	69%
Aquaculture & Fisheries	55%
Global Warming & Ozone Depletion	52%
Forest Resources & Water	47%

A relatively high percentage of visitors were expressly not interested in "global warming & ozone depletion" with 19% of the sample responding that they had no or little interest (i.e., responding with either 1 or 2 on the 5-level scale); 9% and 7% respectively had no or little interest in "forest resources & water" or "aquaculture & fisheries." For all other items, less than 4% of the sample responded that they had no or little interest in the topic.

For most of the issue items, there were no discernible differences in visitors' responses as a function of various demographic or personal characteristics. No differences were observed as a function of home residence, prior knowledge, or social group for: "managing natural resources," "pollution & diseases," "forest resources & water," "nearshore & coastal habitats," and "deep ocean habitats." Visitors with high prior knowledge of marine life were more highly interested than other visitors in "biodiversity & endangered species" (Figure 30). Visitors with high prior knowledge of general science were more interested than others in "habitat loss & oil spills" (Figure 31). In contrast, "aquaculture & fisheries" had more appeal to those with low prior knowledge of general science (Figure 32).

Two of these issue areas were more appealing to all adult and school groups rather than to families, specifically "habitat loss & oil spills" (Figure 33) and "global warming & ozone depletion" (Figure 34).

The following five figures show visitors' responses to items about the four scales of research as a function of their responses to corresponding issue items. In general, the figures show correlations, but some show stronger associations than others between visitors' attitudes toward the scale item and their attitudes toward the associated issue item. In addition, the figures show that many visitors with moderate interest in a particular scale expressed comparatively higher interest in the issue item relevant to that scale.

Figure 35 shows that there was a modest correlation between visitors' interest in the global scale and their interest in the particular global issues tested on the questionnaire, although some visitors with low interest in "Global-scale research" had relatively higher interest in the relevant issue areas. Figures 36 and 37 show that visitors' responses for regional-scale research were roughly correlated with their responses for the relevant issue areas. Figure 38 shows that visitors' interest in the bird's-eye scale was quite closely correlated with interest in biodiversity and endangered species. Figure 39 shows that visitors' were relatively more interested in the issue/research area associated with the microscopic-scale (i.e., pollution & disease) than they were in the scale itself.

Interview Results

Demography and Other Characteristics of the Sample: A total of 60 interviews were conducted over the course of four days, 72% on weekend days and 28% on weekdays. Interviews occurred throughout the day, with half conducted in mornings and half in afternoons. Visitors were nearly equally divided into family groups and all adult groups -- a catagory which included lone adults and couples -- a small number of adults who were part of school groups were also interviewed. The social group distribution was:

55%	All adult group
42%	Families
3%	School groups

Proportionately more families came to the HMSC on weekend days and more school groups came on weekdays (Figure 40). The ages of adults were:

12%	18-30 years
43%	31-45 years
30%	46-65 years
15%	> 66 years

The majority of children were under the age of 12. The percentages of groups with children of the following ages were:

5%	< 3 years
8%	4-6 years
15%	6-8 years
17%	9-12 years
5%	13-15 years
5%	15-17 years

Nearly two-thirds of the sample had attended the HMSC at least once previously. The distribution of visitors' previous visitation was:

38%	First time
30%	Once every few years
15%	1-2 times per year
17%	3 or more times per year

Three-quarters of the sample resided in Oregon. The distribution was:

13%	Lincoln County
23%	Corvaillas/5 county area
22%	Portland and vicinity
17%	Other Oregon
15%	Northwest U.S. & B.C.
8%	Other U.S.
2%	Foreign

There was little variation in the day of the week visitors came to the HMSC as a function of their home residence with the exception that those from Lincoln County were more likely to attend on weekend days (Figure 41). Visitors from Lincoln and the five-county vicinity (i.e., Lane, Benton, Linn, Marion, and Polk) were more likely to be frequent visitors than others who were more likely to be first time visitors (Figure 42).

The overall distribution of visitors' self-description of their prior knowledge of science and marine life was somewhat less than questionnaire responses.[7] The distribution was:

25%	High
33%	Moderate
42%	Low/no knowledge

Many with moderate knowledge felt that although they knew some things, they also knew enough to know how much they did not know:

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[7] This was likely due to the slightly higher number of family groups. It was also possible that when asked in a face to face interview about their prior knowledge, visitors were more conservative in order to appear modest or to avoid being quizzed.

"When you stop to think about it you know a lot, but you really don't know anything";

"I probably don't know anything. I like to think I know a lot but I probably don't know anything...I'm becoming more interested so I can explain things to [my kids]";

"[Only moderate] because there is always so much to know!"

Family groups claimed somewhat less knowledge of science and marine life than all adult groups (Figure 43). With the exception of those from Lincoln County, visitors from Oregon were somewhat less knowledgeable than visitors from elsewhere (Figure 44). Previous attendance at the HMSC positively correlated with high background knowledge in science (Figure 45).

About two-thirds of the sample gave some explanation for how they had acquired their prior knowledge. More than one-third of the visitors had university training and/or professional experiences relevant to science. Some who had had university level courses did not feel confident of their knowledge, claiming to have forgotten much. About 20% of the visitors mentioned that living near or visiting the coast provided them with some background; and another 20% cited avocational interest. Less than 10% each, mentioned reading, school, television, and visiting museums and aquaria.

Reasons for HMSC Attendance: Visitors had relatively consistent explanations for why they came to the HMSC. Slightly more than a quarter of the sample said that they stop at the HMSC every time they are in the Newport area. The distribution of visitors' responses was:

27%	Attend when in area
20%	Curious/have heard about it
20%	A stop on our coastal tour
17%	Interested in marine life
17%	Bring children
15%	Other
10%	We love it here!/come often
7%	Came to learn about something specific
7%	Attend special event
7%	Bring adult
5%	See octopus, tanks, tidal pool
3%	Research interest

"Bring children" included two school groups as well as families. Specific "other" responses included: "went to bookstore" (N=2); and, "wanted to see what had changed" (N=2). Several visitors responded with references to the Oregon Coast Aquarium (OCA): one group came to the HMSC rather than the OCA due to cost; two groups described that they had intended to go the OCA but accidentally found themselves at the HMSC instead.

First time visitors frequently described being curious about the HMSC and attending as a stop along on a coastal tour (Figure 46). Many who attend the HMSC every few years claimed to stop whenever they are in the area. Related to the fact that two times as many all adult groups as families were first time visitors to the HMSC, visitors' reasons for attending the HMSC varied somewhat as a function of social group (Figure 47). Comparatively more all adult groups expressed interest in marine life as a motivation for attendance, and more all adult groups said they were touring the coast and making stops along the way.

There were several groups who described attending the HMSC as a family or personal tradition. Two of these groups fondly remembered an occasion in the past in which the research wings were open to public viewing. Other visitors had come to the HMSC long ago (e.g., "when our daughter was young" or "when I was a kid") and were interested to see what had changed.

Whether or not they had children with them, many visitors made comments describing the HMSC as a good place to bring children. Several all adult groups described having brought children in the past, and a few others said they planned to bring children in the future. As will be elaborated, much of visitors' receptiveness towards proposed thematic and interpretive changes in the Center were filtered through consideration of how both children and "the public" would likely react.

What Liked Best about the HMSC: To get some sense of peoples' current experiences at the HMSC, SLi asked visitors what they particularly enjoyed seeing. The live displays were consistently mentioned. Allowing for multiple responses, the distribution was:

43%	Fish/ecosystem tanks
42%	Octopus
42%	All/everything in general
27%	Tidal pool
20%	Availability of hands-on materials
13%	Whale exhibit
12%	Other
8%	Special events/programs
5%	Volunteers/docents
2%	Plate tectonics
2%	Films

"Other" responses included birds and the estuary trail. Responses of family groups were quite different from those of all adult groups (Figure 48). Family groups were more likely to mention the live animal and ecosystem displays as well as the hands-on materials than were all adult groups. Families were also more likely to cite numerous displays. All adult groups were more likely to describe general interest in all of the displays. There were only a few differences in what visitors liked best as

a function of background knowledge: visitors with high background knowledge of science and/or marine life were more likely to mention the "fish" (i.e., ecosystem) tanks than were others; and those with moderate and low knowledge were more likely to describe having enjoyed the HMSC generally (Figure 49).

Knowledge of, Attitudes Toward, and Specific Interests in Research: Visitors' awareness of the research purpose of the HMSC were consistent with questionnaire responses. For this sample, 60% were aware of the research institute, 27% were not, and 13% were vaguely aware. Typical of those with "vague" awareness, many visitors assumed that given the way the facility was set up, specifically the presence of other buildings, that the HMSC was a research facility. Several groups knew that "this was an OSU place" and thus assumed "there was some sort of research going on here." Some visitors learned that the HMSC was a research facility after arriving. One woman who had visited the OCA prior to the HMSC explained: "I did wonder if there was a tie in to Oregon State, I even asked the man [at the Aquarium] a leading question to find out [but did not get a satisfactory response]." Even for those visitors who knew that the HMSC was a research facility, many spoke as if what went on behind closed doors was something of a mystery: "well, yeah [I knew] somewhat, not really, I know that it is run by some type of research group."

For visitors whose home residence was Oregon, proximity to the HMSC correlated with being aware of the research purpose of the Center (Figure 50). In addition, previous visitation strongly correlated with accurate awareness of the facility's purpose (Figure 51).

There was an indication that for some visitors, the term "research" implied different things than what was intended by the HMSC. Specifically, several visitors took "research" to be knowledge and maintenance of the current displays:

> --"[Research] yes, that'ld be good. That is what I asked them when ... Medusa [octopus] was in the tank ... I know there has to be a whole lot more information that the scientists could give us...";
>
> --"I think it [research] would be interesting because .. [the display] of how the earth is separated, [the boys] were really interested, so I think that if they had something on the animals that were in here, that would be interesting."
>
> --"I assume it [research] is marine related? ... basic environment. How do they get things [specimens]? How do they handle things?..."

Visitors' attitudes toward changing the displays to focus more on research was mixed. Over half of the sample were interested in research, however the attitudes of fully one third of these visitors was "qualified interest." The overall distribution was:

12% Very Interested/positive attitude
23% Interested
34% Qualified Interest
12% Neutral
19% No interest/negative attitude

Visitors varied in their responses toward research depending upon their social group. Figure 52 shows over one-third of the family groups expressed no or negative interest. Although nearly all of those in all adult groups were interested in research, they were evenly divided between those who expressed interest and those who expressed qualified interest. Only visitors in all adult groups were highly interested in research. Previous HMSC visitation appeared to have no affect on visitors' attitudes toward research (Figure 53). Prior awareness of the research purpose of the HMSC was not correlated with attitudes towards research (Figure 54). Visitors with high background knowledge of science and/or marine life were more likely than others to have high interest in research, and only one of these visitors responded negatively. However, the majority of high knowledge visitors expressed qualified interest in the topic of research (Figure 55). Half of those with low background knowledge and 25% with moderate knowledge were either neutral or negative towards the idea of HMSC presenting research.

The following describes visitors' actual responses toward research and provides characterization of the response categories. Most of those who were positive towards a research orientation were personally inclined towards that type of information prior to attending the HMSC:

> -"That would be great...Oh yeah that would be terrific...we'd be very interested in ... whatever they're working on";
>
> -"That'd be good!! [although] I think people still like to see the jelly fish and all, and the octopus."
>
> -"It would be great to know what they're doing, what they're working on."

A few visitors felt that emphasis on research would be beneficial to young people:

> -"Yes [that would be] a good idea, especially for a group like this [large school group of 13 year olds], it would expose them to careers."

Most visitors' with "qualified interest" felt that information about research would be interesting in addition to the current interpretive approach rather than as a substitute:

> -"Yes, but I would like them to do that in addition to the natural history type things. With the emphasis on the animals and the ecosystem and the things that they [animals and ecosystems] do. I would like to not loose any of that but I would also like to gain the scientific research and information that we could have access to."
>
> -"Well, the two [natural history/description and research] go hand in hand. [It would be good] if you had the same, new things would be nice, but in conjunction with the tanks and touching, especially for younger people."
>
> -"It would depend how it looks, any living things [would be interesting]."

Visitors' wariness towards a complete research orientation was related to concern that research information would be too technical and thus be difficult to relate to:

> -"Yes, [that would be] interesting, if it was added to it. But most lay people would not understand if it was too scientific. Like the latin terms, I know what a rock cod is but the latin terms don't mean anything to me."
>
> -"Um, it would be of interest to me if it were made publicly accessible, so that the public would be able to see what was happening and so the kids could see it as a career choice."

Although adults in several family groups were themselves potentially interested in research, their children were young enough that parents described their interests as being dictated by those of their children. Many parents considered research to be a problematic topic for young children. Many also described the HMSC as providing a fun and informative family activity:

> -"Well [we'd be interested] later, when he [son] is in school. [Coming here] is something that we can all three do together..."
>
> "...my kids like to come see the fish ... any thing that has to do with the animals of the coast; that kind of research they would like to see, they're not interested in the plants or the rocks, more the animals."
>
> -"I think that it would be very difficult to take [research] to childrens' level, at least of what I know of the research that goes on here, it's at a pretty advanced level. That'd be tough to do and still be of interest to everybody else...

(Interviewer: Any specific research topics you would be interested in?) I think that, what's the name of the ship, what it does and what NOAA does is pretty interesting, and the weather stuff. But I think it'd be a tough thing to do a good exhibit that could appeal to lower ages (Interviewer: And you think that it should appeal to younger people?) I do, that's my opinion. I think that a lot of the adults that come here, come with kids. So they wouldn't come if there wasn't something for kids."

Visitors who were neutral toward research often had little to say during the interview, and had little apparent interest in technical, abstract information:

-"I don't know, I kind of like looking at the fish...we just look."

Many who were negative towards research cited similar concerns to the "qualified interest" visitors described above, specifically, that research information might be difficult for children, and could be overly technical and unapproachable:

-Man: I do like the educational part that is here now, versus say the OCA. I prefer here..."
-Woman: Yes, and yet its not all education, its kind of low key. ...It's kind of fun and educational which is nice, so its not like going back to school and sitting and listening to all these lectures! So I think the balance is really nice";

-"No, we just like looking at the fish. I'm not interested in the science, period. I hated science";

-"I like it the way it is. There are hands-on [items] and the kids can pick up things. Sometimes when they get too scientific it kind of looses the interest of the kids";

-"[Crinkles her nose] Probably not, we're more into seeing the real thing, maybe in a few years [when kids are older]."

Others who were negative towards a research approach assumed that an emphasis on research would not provide insight into marine life and environments, nor relate concretely to the actual coast:

-"Speaking as a visitor from off the coast, I think the natural [history and description] would be much preferable, rather than the research. The research [would probably be of interest] to local people who are familiar with [the coast], but for a person like myself from the inland, your natural life would be much more interesting. Research is interesting, of course, but I think the natural would be more.";

-"Don't leave out the natural history...if they see it here [at the HMSC] they may [later] see it out there on the beach. I think natural history is very important because many of the mammals and things are disappearing and people won't know what they're missing.";

-"Well, I don't know. I think I'm more interested in the exhibits that you have now, those type of exhibits. I'm not much on the scientific aspects of it [although] I am a scientist and my son is a scientist...well the point is this, my opinion is that most of the general public is interested in the exhibits rather than the scientific aspects. Being a scientist naturally you look at it the other way! But the general public is not interested in the nuts of bolts of projects.";

-"Not really [laugh] (Interviewer: Why not?) I'm interested in the natural things rather than the human aspects. The humans, sure they study and they are probably getting their doctorates or whatever, but that's for the students specializing in oceanography or whatever it might be, not the general public. If you had one display that would be fine (Interviewer: But not the whole facility?) Right."

A number of visitors, some of whom were personally interested in research information, were concerned that the research as a subject might be contrary to, or at least problematic for succinct and concrete presentation to the public. Fifteen percent of the sample spontaneously mentioned that presentation of research may be difficult for "the public." An additional 13% of the sample felt that research may be difficult for children to relate to.

In two separate interviews, couples with high science background conversed about their concerns:

Woman: "I think its very hard to do, to make it interesting for the general public and to also have the research described well. I have these images of scientific posters at meetings that I've been to and they're not very interesting, they can be pretty dry."
Man: "Yeah but you were a protein biologist."
Woman:"Yeah, but I still think that ... its really hard to do, to translate."
Man: "Without meaning to sound snobbish, but we're both physicians so we probably have a different bent anyway. And we have a lot of science in our backgrounds that might make us more interested in seeing some of the behind the scenes in research type of things."

Woman: "Yes, [we'd be interested in] what they are [scientists] trying to find out right now."

Man: "Yeah although it would probably be hard for them to present that to the general public. Still, its not available in current magazines."
Woman: "[I agree] because you'd have to give so much background [to people] before you could get down to what they were working on in the project..."

SLi attempted to encourage all visitors, regardless of their attitudes toward research information, to describe specific research topic(s) that might be of interest. Responses were more reflective of what visitors imagined HMSC researchers study than what the researchers actually study. Nearly one third of the sample (28%) did not or could not name any specific topics. Three visitors knew enough about the HMSC to cite actual research projects, including "the ship," whales, dolphins, the Vents program," "what NOAA does," and "the weather stuff." The following lists the percentage of visitors who mentioned each topic along with at least one verbatim response included to provide descriptive richness to the catagory as well as to show how the categories relate to each other:

28% Environmental/Conservation related, including pollution and endangered species

-"Man's impact. Litter. How humans cause problems. Our effect, like dumping at sea, pressure on resources...People should be aware of what is being lost."

-"Anything about conservation, the coast, trees, birds, whatever."

-"Environmental factors, pollution and effects on the animals, that'd be interesting."
-"Saving our fish, salmon, establishing better estuary eelgrass."

25% General animal related research (other than whales)

-"I think in general, the public, at least me, would like it if it's research more on tangible things that you can see like an animal, a sea lion, rather than say some tidal plankton."

-"Shark exhibit...but I think we need to learn that sharks aren't as aggressive as most people think they are.

-"Maybe sharks, like sand sharks, show that there's more than just what kids see on jaws. More variety of everything, things that the kids don't see in movies so they stop stereotyping."

-"[I'd be interested in] a little bit of everything, in general, and the marine life especially."

-"They ought to do something with the sea lions because people are blaming them and they want to change the marine protection laws to be able to kill them when it's the over fishing and trawling that's caused the problems, not the animals!

20% What are the projects?/ descriptive summaries

-"...Current research in any subject...the latest papers the professors are working on, the graduate students, and some of that structure and how that works out. How they organize their research and what they're currently working on with the ship and stuff like that.

-"I guess it would be kind of interesting to know what kind of research. I don't know what kind of research is being done. To see what they are interested in knowing more about."

20% Connections to the real coast (i.e., what's out there?)

-"Look at some of the specific areas that people are likely to frequent along the coast. Like when you drive up the coast you see the sea lions caves, you see devils gulf or what ever its called, devils cauldron. So people coming from those areas or going to them would then have a stronger interest in examining those environments [in materials at the HMSC] rather than if [the displays were] just sort of a generic displays that they don't relate. And certainly within the variety of sites, there must be quite a lot of different fields of study that you cover [in terms of research with relevance] within those different environments."

-"Local, anything that had to do with the local land..."

-"I don't know...how does scientists' work relate to the animals...How long do fish live. What's indigenous to the coast. Things that relate to here."

-"In my opinion [include] a little less on the development of the coast line and more on what lives out there off the coast."

13% Whale research

-"Whales, see how many whales actually go by here. do they keep track of them? The spawns? The families?

-[Is there] a study of all the whales along the west coast and which identifies them individually? That would interest me, something that ties in specifically to what you see when you're out there.

13% Why and how scientists study what they do

-"I think we should let the public in on some of the big questions facing marine biology, [and] it would be interesting to see what the public came up with."

-"[Include] exhibits about how to do research, why to do research."

12% Particular habitat/ecosystem

Several visitors mentioned deep sea and microscopic environments as being of particular interest.

8% Tsunamis/wave action

-"I'd kind of like to know about the wave formation and different terminologies concerning the wave structures and what causes the waves. Why they're sometimes larger and sometimes smaller. We moved from the Midwest in September and so you know the ocean is a whole new thing to us."

8% Animal behavior

-"Beaching of whales"

-"I kayak so I know about the coast from a non-expert point of view, from seeing stuff, but I don't have any scientific knowledge of what I'm looking at. I guess I'd like to. I'd like to know why seals group in certain areas, why are seals interested in following me in my boat, just from a practical point of view?"

-"We were in Depue Bay yesterday. [When on the beach] at first I thought [what I saw] was a great big log and then I saw that it was a sea lion. I had never seen one like that and I thought, 'why did this happen to this poor animal?' So the research is quite important."

7% Geology and geography of area/coastline

-"I graduated in geology, so we're interested more in the geology part of it than the animals really, but the animals are neat."

-"Well, the shelf, the continental shelf and [connection to] earthquakes."

7% Fisheries/fishing

-"There's been a lot of reduction of salmon...we worry about there reproduction..."

7% Ecological effects of policy/regulations

-"If they cut off the salmon for sport fishermen, then they [fishermen] all go for sturgeon, what [then] will happen to the sturgeon?"

3% Resource management

-"...The effects of pollution on the environment...or the harvesting of fish, what's the outcome on the fish as far as the population and how fast can it regenerate..."

2% Plate tectonics

-"I always like to see what the latest theory is on plate tectonics."

The most elaborate responses were given by those interested in environmental and conservation related projects. Many visitors presumed that this was the type of research undertaken at the HMSC:

-"Oh yeah, because [research] shows what the whole earth is going to do if we don't take care of it now. We're all going to be in trouble, for our kids and grandkids."

-"Well, of course, what is of primary concern these days I think is the pollution and the effect on the environment and how much of the natural world is being destroyed. And, I take it the research work is directed along some of those lines...prevention of destruction."

Family groups often gave no specific areas of research that might be of interest (Figure 56). Family groups who did provide a specific response tended to mention tangible subjects: environmental & conservation related; animal research; and, things that connect to the real coastline. These areas were equally of interest to all adult groups. All adult groups were also interested in more basic insight into the nature, purpose, and procedures involved in research projects at the HMSC.

Since background knowledge was observed to vary as a function of social group (see Figures 7 & 8), variations described above based on social group are also evident as a function of background knowledge (Figure 57). Those with high background knowledge were more likely than others to be interested in the context of the research projects -- their

nature, purpose, and the procedures involved. Visitors with moderate knowledge were frequently interested in environmental & conservation issues, and those with low knowledge were often unable to name any specific research area. Figure 58 shows that areas of research of interest to visitors varied little as a function of home residence.

Visitors' Attitudes Toward the Four Scales of Research Organizational Theme: Half of the sample expressed positive interest in the four scales of research. The remainder were either neutral, negative, or had no opinion. The overall distribution of responses was:

15% Very positive
34% Positive
17% Neutral
10% Negative
24% No comment/No opinion

Attitudes towards the four scales of research did not vary as a function of home residence or prior visitation to the HMSC. Attitudes did vary however as a function of social group. Figure 59 shows that only all adult groups expressed very positive attitudes.

There were no correlations between visitors' attitudes toward the four scales of research as a function of their awareness of the research purpose of the HMSC, except that many who were unaware of the Center's purpose had no opinion about the four scale theme (Figure 60).

Figure 61 shows a positive correlation between knowledge of science and/or marine life and visitors' attitudes toward the four scales of research. Sixty percent of both those with high and moderate background knowledge were either positive or very positive; in contrast, 70% of those with low background had no, neutral, or negative opinions. Consistent with these results, visitors whose attitudes toward featuring research in the future visitor center were positive, were also positive towards the four scales of research; whereas those who had neutral or negative attitudes towards research were neutral or negative towards the four scales theme (Figure 62).

Those who were most positive towards the four scales of research spoke favorably about being able to visualize things, namely global and microscopic scales, that in real life were abstract and intangible:

> -"Interesting because you don't see the microscopic or the global scale [you see the local scale]. The four would be good together."

-"[The microscopic] sounds interesting because few people have any idea what is in the water...and [have the opportunity to] see all the little things that you've never heard of, [and you] can see it, awesome! It's awesome when you think of all the things that are out in that ocean!"

Others who were positive felt that the four scales theme would allow connections between scales to be explored:

-"Oh yeah, a little of it all, it all fits together."

-"I think it would be [good], because we've seen where activities in Japan do influence activities here and the waves and the tides and so on."

-"Well yeah, because it is all intertwined and occurrences here have effects over there. If you can bring it in at a large scale as well as the minute scale, [although] that's a pretty broad perspective there. That would be a difficult one to do."

-"Sure yeah, it all ties together."

Some visitors had little response but expressed positive attitudes:

-"That sounds reasonable."

-"[Sounds] logical."

Those visitors who were neutral or negative associated the four scales with abstract science, removed from tangible evidence, and from social and personal relevance:

-"Might be [good]. I hope they would not ruin it though. (Interviewer: How would they ruin it?) People like to see things up close."

-"I don't know, it just seems to get so scientific and so technical that they kind of loose their objective of what they are trying to teach people about. They're trying to teach people, you know, to preserve nature. But when they get so scientific I think they kind of get away from that."

-"Ummmm, I don't know. I'd have to see what they do. What they [scientists] might think is really neat, they might be the only ones who think so, [and there are only] a half a dozen people who think so."

Another reason for visitors' misgivings toward the four scales theme was that the approach was perceived to compromise emphasis on the Oregon Coast and indigenous marine life:

-"I would enjoy the last two [real scale & microscopic scale]. I come to the Oregon Coast and I come here to see what is happening in my waters. On a national or world scale, well, the world scale is interesting but you can get that on the Discovery Channel. But when you come to the Oregon Coast and then you come to an Oregon coast type research place, which this is, then I'd rather see [things pertaining to] here, on a regional basis or a local basis. To go too big with it, it becomes unimportant for Newport, it becomes unimportant for the Oregon Coast."

DISCUSSION

Overall, nearly 75% of the visitors included in the sample for this study were from Oregon. Somewhat more all adult groups than families were included, and only a very few school groups. Nearly 70% of the sample had at least a vague awareness that the HMSC was a research institute, although few visitors had any concrete knowledge of the research actually conducted or appreciation for the importance of the facility.

For most visitors, the HMSC was a part of their visit to the Oregon Coast. The importance of this association cannot be overemphasized. Visitors to the HMSC had a strong orientation toward seeing and closely interacting with marine life and environments. Regardless of their background knowledge of science, most visitors attended the HMSC in order to do something fun and interesting. No visitors mentioned research or science, per se, as a major motivation for visiting HMSC. Attending the HMSC was an extension of seeing and exploring real Oregon Coastal environments.

Visitors uniformly considered the HMSC to be accessible and enjoyable for all ages, and to many visitors this was the primary reason for current and continued HMSC attendance. All adult groups were more likely to have higher background knowledge of science and more interest in research than families. Results indicated that families and all adult groups had somewhat different, although largely consistent perspectives. Visitors with moderate to low background knowledge (especially family groups) were somewhat more receptive to presentations about the basic method and procedures of science than were visitors with higher background knowledge (especially those in all adult groups). Many family groups (roughly one-third) expressed neutral or negative attitudes toward research; and although, most all adult groups were interested in research, over half expressed only qualified interest. In total, fully two-thirds of the sample expressed some hesitancy towards a research focus for the future visitor center.

Regardless of social group or background knowledge, visitors' hesitancy toward a research orientation was based on two related issues. First, visitors tended to have preconceptions about the concepts "science" and "research" leading many to assume that future presentations would be overly abstract, and unrelated to the "real" coast and "real" marine life. Some visitors' preconceptions were informed by actual knowledge of science and of the HMSC, while others were not.

Secondly, since peoples' visits to the HMSC was literally and conceptually tied to visits to the Oregon coast, often strongly motivated by a high interest in marine life, visitors tended to judge potential presentations of research exhibits in

terms of its compatibility with presentations of marine life and environments. For many visitors, the subjects were either not compatible or were only somewhat compatible.

Although "research" and "science" as abstract concepts were somewhat problematic for people, when discussion turned to specific topics or issues related to research, many visitors were more positive. This tendency was strongly apparent in results from both questionnaires and interviews:

1) Questionnaire results for various exhibit themes showed that visitors were more interested in the "Consequences and Use of Research" than they were in either "Learning about the Scientific Method" or in "Searching for Patterns in a Complex World." This was likely because "Consequences and Use of Research" related to, and was thus compatible with visitors' interests in conservation of marine life and environments.

2) Of the various exhibit media tested, visitors were most positive toward "Live Animal Displays" and "Hands-on Exhibits." Both of these media would enable first hand experiences with marine life.

3) Results from testing of the four scales of research show that, of the four, visitors were most interested in the one-to-one scale and in the regional scale -- both of which were perceived to be tangibly connected to real Oregon coastal environments and issues. Visitors were less positive towards the global and microscopic scales which were deemed less relevant to the Oregon coast. Interestingly, those who were positive towards the global and microscopic scales often explained their attitudes in terms of a logic which connected the global and the microscopic to a local or regional situation (e.g., visitors interested in Tsunamis realized that what starts in Asia has effects in Oregon; an interest in what is present, but cannot be seen in the micro-environment of a drop of "local" ocean water).

4) Results from testing of various issue items showed that visitors were most positive towards two topics closely related to marine life, "nearshore and coastal habitats" and "deep ocean habitats." Issues more removed from marine environments were least attractive, namely "global warming & ozone depletion" and "forest resources & water."

5) In correlations run between visitors' responses to a particular scale and their responses to an issue at that scale, the 1:1 scale and the regional, bird's eye view scale were most positively correlated with their respective issue items (i.e., visitors were equally interested in both the issues and the scales). In contrast, for both the global

and the microscopic scales, visitors expressed generally greater interest in the issue items than in the scales themselves.

6) Interview results confirmed that visitors were most receptive to research with explicit, tangible connections to real coastal environments. Three of the most frequent response categories directly related to the Oregon coast: "environmental & conservation related"; "marine animal related"; and, "connections to the real coast." In general, visitors were most interested in research with applications and implications for alleviating coastal and ocean ecological problems and for understanding marine life and environments.

The more receptive visitors were to "research" as a concept, the more positive they were toward the four scales of research. Visitors who were positive and those who were negative towards the four scales of research were essentially responding to the same issue but from different angles. Specifically, visitors valued presentations which will give visual and tangible representations of what is normally not accessible. How visitors varied was in their judgements regarding whether the various scales and corresponding issue areas were amenable to tangible, concrete representation.

CONCLUSIONS

Results of this study indicate that visitors will be receptive to plans for the future visitors center if the themes and contents of the displays have clear connections to marine life and coastal environments, and enable first-hand experiences with the subject matter. As development of the visitor center continues, specific exhibit concepts and displays should continue to be tested with a cross-section of different types of visitors.

The major theoretical implications of this study are that there are two directions to approach the presentation of science and research information within the context of HMSC, each with its own distinct starting point and directional logic. The first starts with how science works (i.e., the scientific method), what science is (i.e., its logic and processes), what research occurs at the HMSC, and finally, comes around to the implications and applications of that research to real human problems. The second approach is the opposite. It starts with showing that there are all kinds of interesting, baffling things in the world (i.e., different marine life forms, different marine habitats and phenomena) and that there are some important questions and problems associated with all those neat things (e.g., environmental & conservation issues; why certain animals do what they do, etc.); and then moves to the notion that research -- the process of science -- is undertaken at the HMSC in order to explore those questions and to help solve those problems.

The second of these two approaches seems to more fully capture the expectations, interests and knowledge base of current HMSC visitors; we believe it would more fruitfully lead visitors to the perspectives that the HMSC would like to communicate. This approach would build upon what is shared by the majority of HMSC scientists and visitors: a passion for and curiosity about the marine environment. This approach would appear to acknowledge that, just as scientific research cannot proceed without an initial hypothesis and collection of data, the same is true of visitors. Visitors arrive with a set of initial hypotheses about the world (and what they expect to do/see at HMSC). They require, in fact desire, to obtain "data" from the HMSC in order to verify these hypotheses as well as to reach new insights. When successful, this process results in a meaningful visitor experience. The approach we propose starts with real things found in the world, things of interest to visitors. This can then be followed by discussions about the nature of the scientific inquiry being undertaken to understand those real things. Tangible illustrations of marine life and environments, presented as primary data, would enable visitors to make empirically grounded explorations and both formulate their own questions as well as consider HMSC scientist's questions. Given this approach, the scientific enterprise at the HMSC should be both interesting and relevant to visitors.

Home Residence	Previous Visitation: First time	Once or twice before	1-2 times/yr	3 or more/yr	Overall
Lincoln County	0.0	18.5	0.0	23.1	10.4
Corvallas/5 County local	11.1	14.8	44.4	61.5	24.7
Portland area/Other OR	40.7	51.9	33.3	15.4	39.0
Northwest of US	18.5	11.1	22.2	0.0	13.0
Other US	25.9	3.7	0.0	0.0	10.4
Foreign	3.7	0.0	0.0	0.0	1.3
Total	100.0	100.0	100.0	100.0	100.0
Number of Replies	27	27	9	13	77

Figure 1. Home residence as a function of previous HMSC visitation.

Why visit HMSC	Social group: Family	All Adult Group	School Group	All Kid Group	Overall
See exhibits	72.0	61.5	66.7	-	65.0
Particular topic	12.0	17.3	0.0	-	15.0
Do something fun	64.0	55.8	33.3	-	57.5
Check it out generally	48.0	53.8	0.0	-	50.0
Quake fair	0.0	3.8	0.0	-	2.5
Bring children	32.0	1.9	0.0	-	11.3
Other	16.0	5.8	100.0	-	12.5
Total	*	*	*	*	*
Number of Replies	25	52	3	0	80

Note: * Multiple answers allowed.

Figure 2. Reasons for attending the HMSC as a function of social group.

What expect to see?	Age of adult: 18-30	31-45	46-60	>60	Overall
Exhibits generally	26.1	47.8	30.0	33.3	28.2
Marine life	60.9	43.5	50.0	50.0	41.0
Tanks/natural env.	26.1	26.1	20.0	0.0	17.9
To learn	30.4	8.7	10.0	16.7	14.1
More/larger/different	4.3	0.0	10.0	0.0	2.6
Other	8.7	4.3	0.0	16.7	5.1
Total	*	*	*	*	*
Number of Replies	23	23	10	6	78

Note: * Multiple answers allowed.

Figure 3. What visitors expected to see at the HMSC as a function of age of adult.

Aware researchers @ HMSC?	Previous Visitation: First time	Once or twice before	1-2 times/yr	3 or more/yr	Overall
Yes	51.9	78.6	88.9	84.6	71.4
No	33.3	17.9	11.1	15.4	22.1
Unsure	14.8	3.6	0.0	0.0	6.5
Total	100.0	100.0	100.0	100.0	100.0
Number of Replies	27	28	9	13	77

Figure 4. Whether visitors were aware of the research function of the HMSC as a function of previous attendance.

Home Residence	Aware researchers @ HMSC? Yes	No	Unsure	Overall
Lincoln County	14.8	0.0	0.0	10.0
Corvaillas/5 County local	25.9	22.2	20.0	23.8
Portland area/Other OR	33.3	55.6	40.0	37.5
Northwest of US	16.7	11.1	0.0	13.8
Other US	7.4	11.1	40.0	10.0
Foreign	1.9	0.0	0.0	1.3
Total	100.0	100.0	100.0	100.0
Number of Replies	54	18	5	80

Figure 5. Whether visitors were aware of the research function of the HMSC as a function of home residence.

Knowledge general science	Knowledge marine life & c A lot	Moderate	A little	Overall
A lot	81.8	15.6	0.0	20.0
Moderate	18.2	68.9	33.3	51.3
A little	0.0	15.6	66.7	28.8
Total	100.0	100.0	100.0	100.0
Number of Replies	11	45	24	80

Figure 6. Visitors' prior knowledge of general science as a function of their prior knowledge of marine life & environments.

Knowledge general science	Social group Family	All Adult Group	School Group	All Kid Group	Overall
A lot	8.0	25.0	33.3	-	20.0
Moderate	60.0	46.2	66.7	-	51.3
A little	32.0	28.8	0.0	-	28.8
Total	100.0	100.0	100.0	100.0	100.0
Number of Replies	25	52	3	0	80

Figure 7. Visitors' prior knowledge of general science as a function of social group.

Knowledge marine life & c	Social group Family	All Adult Group	School Group	All Kid Group	Overall
A lot	4.0	17.3	33.3	-	13.8
Moderate	64.0	53.8	33.3	-	56.3
A little	32.0	28.8	33.3	-	30.0
Total	100.0	100.0	100.0	100.0	100.0
Number of Replies	25	52	3	0	80

Figure 8. Visitors' prior knowledge of marine life & environments as a function of social group.

Home Residence	Knowledge general science				Number of Replies
	A lot	Moderate	A little	Total	
Lincoln County	12.5	50.0	37.5	100.0	8
Corvaillas/5 County local	10.5	63.2	26.3	100.0	19
Portland area/Other OR	23.3	46.7	30.0	100.0	30
Northwest of US	36.4	54.5	9.1	100.0	11
Other US	12.5	37.5	50.0	100.0	8
Foreign	100.0	0.0	0.0	100.0	1
Overall	20.8	50.6	28.6	100.0	77

Figure 9. Visitors' prior knowledge of general science as a function of home residence.

Home Residence	Knowledge marine life & c				Number of Replies
	A lot	Moderate	A little	Total	
Lincoln County	12.5	75.0	12.5	100.0	8
Corvaillas/5 County local	5.3	63.2	31.6	100.0	19
Portland area/Other OR	13.3	53.3	33.3	100.0	30
Northwest of US	27.3	54.5	18.2	100.0	11
Other US	25.0	12.5	62.5	100.0	8
Foreign	0.0	100.0	0.0	100.0	1
Overall	14.3	54.5	31.2	100.0	77

Figure 10. Visitors' prior knowledge of marine life & environments as a function of home residence.

Why visit HMSC	Knowledge general science			
	A lot	Moderate	A little	Overall
See exhibits	50.0	68.3	69.6	65.0
Particular topic	12.5	12.2	21.7	15.0
Do something fun	68.8	56.1	52.2	57.5
Check it out generally	62.5	48.8	43.5	50.0
Quake fair	0.0	2.4	4.3	2.5
Bring children	12.5	12.2	8.7	11.3
Other	18.8	14.6	4.3	12.5
Total	*	*	*	*
Number of Replies	16	41	23	80

Note: * Multiple answers allowed.

Figure 11. Reasons for attending the HMSC as a function of prior knowledge of general science.

How aquire knowledge?	Knowledge general science A lot	Moderate	A little	Overall
College study	62.5	34.1	0.0	30.0
"School"	18.8	24.4	8.7	18.8
Television	0.0	14.6	13.0	11.3
Reading	6.3	24.4	30.4	22.5
Visit aquaria/museums	18.8	14.6	17.4	16.3
Recr/avocational	6.3	2.4	4.3	3.8
Observe/visit coast	6.3	29.3	17.4	21.3
Professional	0.0	7.3	4.3	5.0
No response	18.8	14.6	30.4	20.0
Total	*	*	*	*
Number of Replies	16	41	23	80

Note: * Multiple answers allowed.

Figure 12. How visitors aquired their prior knowledge as a function of extent of prior knowledge of general science.

How aquire knowledge?	Knowledge marine life & c A lot	Moderate	A little	Overall
College study	63.6	31.1	12.5	30.0
"School"	18.2	20.0	16.7	18.8
Television	0.0	11.1	16.7	11.3
Reading	0.0	22.2	33.3	22.5
Visit aquaria/museums	9.1	15.6	20.8	16.3
Recr/avocational	18.2	2.2	0.0	3.8
Observe/visit coast	0.0	33.3	8.3	21.3
Professional	0.0	8.9	0.0	5.0
No response	18.2	22.2	16.7	20.0
Total	*	*	*	*
Number of Replies	11	45	24	80

Note: * Multiple answers allowed.

Figure 13. How visitors aquired their prior knowledge as a function of prior knowledge of marine life & environments.

How aquire knowledge?	Home Residence Lincoln County	Corvaillas/5 County local	Portland area/Other OR	Northwest of US	Other US	Foreign	Overall
College study	25.0	15.8	30.0	72.7	25.0	0.0	31.2
"School"	12.5	31.6	20.0	18.2	0.0	0.0	19.5
Television	0.0	15.8	13.3	9.1	12.5	0.0	11.7
Reading	0.0	21.1	26.7	27.3	25.0	0.0	22.1
Visit aquaria/museums	12.5	26.3	16.7	0.0	25.0	0.0	16.9
Recr/avocational	12.5	0.0	0.0	0.0	25.0	0.0	3.9
Observe/visit coast	50.0	31.6	16.7	0.0	12.5	0.0	20.8
Professional	25.0	0.0	3.3	9.1	0.0	0.0	5.2
No response	12.5	15.8	16.7	9.1	37.5	100.0	18.2
Total	*	*	*	*	*	*	*
Number of Replies	8	19	30	11	8	1	77

Note: * Multiple answers allowed.

Figure 14. How visitors aquired their prior knowledge as a function of home residence.

	Learn Scientific Method	Patterns in Complexity	Res. Consequences & Use
1 No interest	12.7	11.7	2.6
2 Mild interest	8.9	11.7	3.9
3 So So/neutral	40.5	26.0	18.2
4 Moderate intr	25.3	32.5	29.9
5 High interest	12.7	16.9	44.2
No response	0.0	1.3	1.3
Total	100.0	100.0	100.0
Number of Replies	79	77	77

Figure 15. Distribution of visitors responses for several exhibit themes/ topics.

	Knowledge general science			
Patterns in Complexity	A lot	Moderate	A little	Overall
1 No interest	6.3	15.0	9.5	11.3
2 Mild interest	6.3	15.0	9.5	11.3
3 So So/neutral	12.5	22.5	42.9	25.0
4 Moderate intr	62.5	25.0	23.8	31.3
5 High interest	12.5	22.5	9.5	16.3
No response	0.0	0.0	4.8	1.3
Total	100.0	100.0	100.0	100.0
Number of Replies	16	40	21	80

Figure 16. Visitors' attitudes toward "Searching for Patterns in Complexity" as a function of prior knowledge of general science.

	Social group				
Patterns in Complexity	Family	All Adult Group	School Group	All Kid Group	Overall
1 No interest	20.0	8.2	0.0	-	11.3
2 Mild interest	12.0	10.2	33.3	-	11.3
3 So So/neutral	28.0	26.5	0.0	-	25.0
4 Moderate intr	24.0	34.7	66.7	-	31.3
5 High interest	16.0	18.4	0.0	-	16.3
No response	0.0	2.0	0.0	-	1.3
Total	100.0	100.0	100.0	100.0	100.0
Number of Replies	25	49	3	0	80

Figure 17. Visitors' attitudes toward "Searching for Patterns in Complexity" as a function of social group.

	Knowledge marine life & c			
Res. Consequences & Use	A lot	Moderate	A little	Overall
1 No interest	0.0	2.3	4.3	2.5
2 Mild interest	0.0	2.3	8.7	3.8
3 So So/neutral	9.1	23.3	13.0	17.5
4 Moderate intr	54.5	34.9	8.7	28.8
5 High interest	36.4	37.2	60.9	42.5
No response	0.0	0.0	4.3	1.3
Total	100.0	100.0	100.0	100.0
Number of Replies	11	43	23	80

Figure 18. Visitors' attitudes toward the "Consequences and Uses of Research" as a function of prior knowledge of marine life & environments.

Learn Scientific Method	Social group Family	All Adult Group	School Group	All Kid Group	Overall
1 No interest	12.0	13.7	0.0	-	12.5
2 Mild interest	8.0	7.8	33.3	-	8.8
3 So So/neutral	32.0	45.1	33.3	-	40.0
4 Moderate intr	40.0	19.6	0.0	-	25.0
5 High interest	8.0	13.7	33.3	-	12.5
No response	0.0	0.0	0.0	-	0.0
Total	100.0	100.0	100.0	100.0	100.0
Number of Replies	25	51	3	0	80

Figure 19. Visitors' attitudes toward "Learning about the Scientific Method" as a function of social group.

Learn Scientific Method	Knowledge general science A lot	Moderate	A little	Overall
1 No interest	25.0	15.0	0.0	12.5
2 Mild interest	6.3	10.0	8.7	8.8
3 So So/neutral	56.3	32.5	43.5	40.0
4 Moderate intr	12.5	32.5	21.7	25.0
5 High interest	0.0	10.0	26.1	12.5
No response	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0
Number of Replies	16	40	23	80

Figure 20. Visitors' attitudes toward "Learning about the Scientific Method" as a function of prior knowledge of general science.

Learn Scientific Method	Knowledge marine life & c A lot	Moderate	A little	Overall
1 No interest	0.0	20.5	4.2	12.5
2 Mild interest	0.0	11.4	8.3	8.8
3 So So/neutral	81.8	31.8	37.5	40.0
4 Moderate intr	9.1	27.3	29.2	25.0
5 High interest	9.1	9.1	20.8	12.5
No response	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0
Number of Replies	11	44	24	80

Figure 21. Visitors' attitudes toward "Learning about the Scientific Method" as a function of their prior knowledge of marine life & environments.

	Meet a Marine Scientist	Video of Scientists	Live Animal Displays	Use Interactive Computers	Hands-on Exhibits	See Tools & Equipment
1 No interest	5.1	5.1	0.0	7.9	0.0	1.3
2 Mild interest	3.8	7.6	0.0	7.9	1.3	10.0
3 So So/neutral	27.8	22.8	2.5	19.7	13.8	31.3
4 Moderate intr	35.4	27.8	11.3	30.3	17.5	31.3
5 High interest	27.8	34.2	85.0	31.6	60.0	18.8
No response	0.0	2.5	1.3	2.6	7.5	7.5
Total	100.0	100.0	100.0	100.0	100.0	100.0
Number of Replies	79	79	80	76	80	80

Figure 22. Distribution of visitors' responses to various exhibit media.

Live Animal Displays	Social group Family	All Adult Group	School Group	All Kid Group	Overall
1 No interest	0.0	0.0	0.0	-	0.0
2 Mild interest	0.0	0.0	0.0	-	0.0
3 So So/neutral	4.0	1.9	0.0	-	2.5
4 Moderate intr	0.0	17.3	0.0	-	11.3
5 High interest	96.0	78.8	100.0	-	85.0
No response	0.0	1.9	0.0	-	1.3
Total	100.0	100.0	100.0	100.0	100.0
Number of Replies	25	52	3	0	80

Figure 23. Visitors' attitudes toward "Seeing Live Animal Displays" as a function of social group.

Hands-on Exhibits	Social group Family	All Adult Group	School Group	All Kid Group	Overall
1 No interest	0.0	0.0	0.0	-	0.0
2 Mild interest	0.0	1.9	0.0	-	1.3
3 So So/neutral	4.0	17.3	33.3	-	13.8
4 Moderate intr	4.0	23.1	33.3	-	17.5
5 High interest	88.0	48.1	33.3	-	60.0
No response	4.0	9.6	0.0	-	7.5
Total	100.0	100.0	100.0	100.0	100.0
Number of Replies	25	52	3	0	80

Figure 24. Visitors' attitudes toward "Using Hands-on Exhibits" as a function of social group.

Use Interactive Computers	Knowledge marine life & c A lot	Moderate	A little	Overall
1 No interest	0.0	7.1	12.5	7.5
2 Mild interest	10.0	9.5	4.2	7.5
3 So So/neutral	60.0	7.1	25.0	18.8
4 Moderate intr	10.0	45.2	12.5	28.8
5 High interest	20.0	26.2	45.8	30.0
No response	0.0	4.8	0.0	2.5
Total	100.0	100.0	100.0	100.0
Number of Replies	10	42	24	80

Figure 25. Visitors' attitudes toward "Using Interactive Computers" as a function of prior knowledge of marine life & environments.

	Global-scale	Regional-scale	Ecosystem & animal scale	Microscopic-scale
1 No interest	1.3	0.0	0.0	1.3
2 Mild interest	6.3	2.5	3.8	10.0
3 So So/neutral	27.5	26.6	15.0	32.5
4 Moderate intr	40.0	41.8	37.5	28.8
5 High interest	18.8	24.1	36.3	18.8
No response	6.3	5.1	7.5	8.8
Total	100.0	100.0	100.0	100.0
Number of Replies	80	79	80	80

Figure 26. Distribution of visitors' response toward the four scales of research.

Microscopic-scale	Knowledge general science A lot	Moderate	A little	Overall
1 No interest	0.0	2.4	0.0	1.3
2 Mild interest	0.0	9.8	17.4	10.0
3 So So/neutral	43.8	34.1	21.7	32.5
4 Moderate intr	50.0	24.4	21.7	28.8
5 High interest	6.3	17.1	30.4	18.8
No response	0.0	12.2	8.7	8.8
Total	100.0	100.0	100.0	100.0
Number of Replies	16	41	23	80

Figure 27. Visitors' attitudes toward "Research at the Microscopic-Scale" as a function of prior knowledge of general science.

Microscopic-scale	Knowledge marine life & c A lot	Moderate	A little	Overall
1 No interest	0.0	2.2	0.0	1.3
2 Mild interest	0.0	8.9	16.7	10.0
3 So So/neutral	72.7	26.7	25.0	32.5
4 Moderate intr	18.2	35.6	20.8	28.8
5 High interest	9.1	15.6	29.2	18.8
No response	0.0	11.1	8.3	8.8
Total	100.0	100.0	100.0	100.0
Number of Replies	11	45	24	80

Figure 28. Visitors' attitudes toward "Research at the Microscopic-scale" as a function of prior knowledge of marine life & environments.

	Manage Natural Resources	Pollution & Diseases	Biodiversity/Endan. Spec.	Habitat loss/Oil Spills
1 No interest	0.0	1.3	1.3	0.0
2 Mild interest	3.8	3.8	2.5	3.8
3 So So/neutral	15.2	18.8	20.3	19.0
4 Moderate intr	38.0	37.5	22.8	35.4
5 High interest	36.7	31.3	46.8	35.4
No response	6.3	7.5	6.3	6.3
Total	100.0	100.0	100.0	100.0
Number of Replies	79	80	79	79

Continued...

	Global Warming/ Ozone depl	Aquaculture & Fisheries	Forest Resources & Water	Nearshore/Coastal Hab.
1 No interest	7.5	3.8	1.3	0.0
2 Mild interest	11.3	3.8	7.7	2.5
3 So So/neutral	23.8	27.5	33.3	10.0
4 Moderate intr	30.0	26.3	26.9	33.8
5 High interest	22.5	28.8	21.8	48.8
No response	5.0	10.0	9.0	5.0
Total	100.0	100.0	100.0	100.0
Number of Replies	80	80	78	80

Continued...

	Deep Ocean Habitats
1 No interest	0.0
2 Mild interest	2.5
3 So So/neutral	10.0
4 Moderate intr	27.5
5 High interest	55.0
No response	5.0
Total	100.0
Number of Replies	80

Figure 29. Distribution of visitors' responses for issue areas related to research.

Biodiversity/Endan. Spec.	Knowledge marine life & c A lot	Moderate	A little	Overall
1 No interest	0.0	0.0	4.2	1.3
2 Mild interest	0.0	2.3	4.2	2.5
3 So So/neutral	9.1	25.0	16.7	20.0
4 Moderate intr	27.3	20.5	25.0	22.5
5 High interest	63.6	43.2	45.8	46.3
No response	0.0	9.1	4.2	6.3
Total	100.0	100.0	100.0	100.0
Number of Replies	11	44	24	80

Figure 30. Visitors' attitudes toward "Biodiversity and endangered species" as a function of their prior knowledge of marine life & environments.

Habitat loss/Oil Spills	Knowledge general science A lot	Moderate	A little	Overall
1 No interest	0.0	0.0	0.0	0.0
2 Mild interest	6.3	0.0	9.1	3.8
3 So So/neutral	0.0	24.4	22.7	18.8
4 Moderate intr	31.3	41.5	27.3	35.0
5 High interest	62.5	26.8	31.8	35.0
No response	0.0	7.3	9.1	6.3
Total	100.0	100.0	100.0	100.0
Number of Replies	16	41	22	80

Figure 31. Visitors' attitudes toward the topic "Marine habitat loss & oil spills" as a function of their prior knowledge of general science.

Aquaculture & Fisheries	Knowledge general science A lot	Moderate	A little	Overall
1 No interest	6.3	4.9	0.0	3.8
2 Mild interest	6.3	4.9	0.0	3.8
3 So So/neutral	37.5	26.8	21.7	27.5
4 Moderate intr	18.8	26.8	30.4	26.3
5 High interest	25.0	24.4	39.1	28.8
No response	6.3	12.2	8.7	10.0
Total	100.0	100.0	100.0	100.0
Number of Replies	16	41	23	80

Figure 32. Visitors' attitudes toward information about "Aquaculture, Fisheries and Seafood" as a function of their prior knowledge of general science.

Habitat loss/Oil Spills	Social group Family	All Adult Group	School Group	All Kid Group	Overall
1 No interest	0.0	0.0	0.0	-	0.0
2 Mild interest	4.0	3.9	0.0	-	3.8
3 So So/neutral	36.0	9.8	33.3	-	18.8
4 Moderate intr	36.0	37.3	0.0	-	35.0
5 High interest	16.0	43.1	66.7	-	35.0
No response	8.0	5.9	0.0	-	6.3
Total	100.0	100.0	100.0	100.0	100.0
Number of Replies	25	51	3	0	80

Figure 33. Visitors' attitudes toward information about "Marine habitat loss and oil spills" as a function of social group.

Global Warming/Ozone depl	Family	Social group All Adult Group	School Group	All Kid Group	Overall
1 No interest	12.0	5.8	0.0	-	7.5
2 Mild interest	20.0	7.7	0.0	-	11.3
3 So So/neutral	32.0	21.2	0.0	-	23.8
4 Moderate intr	16.0	34.6	66.7	-	30.0
5 High interest	16.0	25.0	33.3	-	22.5
No response	4.0	5.8	0.0	-	5.0
Total	100.0	100.0	100.0	100.0	100.0
Number of Replies	25	52	3	0	80

Figure 34. Visitors' attitude toward information about "Global warming & ozone depletion" as a function of social group.

Global Warming/Ozone depl	1 No interest	2 Mild interest	Global-scale 3 So So/ neutral	4 Moderate intr	5 High interest	No response	Overall
1 No interest	0.0	20.0	4.5	6.3	13.3	0.0	7.5
2 Mild interest	0.0	0.0	18.2	12.5	6.7	0.0	11.3
3 So So/neutral	0.0	0.0	36.4	25.0	20.0	0.0	23.8
4 Moderate intr	0.0	80.0	18.2	37.5	20.0	20.0	30.0
5 High interest	0.0	0.0	22.7	18.8	40.0	20.0	22.5
No response	100.0	0.0	0.0	0.0	0.0	60.0	5.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of Replies	1	5	22	32	15	5	80

Figure 35. Visitors responses for the Global scale of research as a function of their responses for global issues.

Aquaculture & Fisheries	1 No interest	2 Mild interest	Regional-scale 3 So So/ neutral	4 Moderate intr	5 High interest	No response	Overall
1 No interest	-	50.0	4.8	3.0	0.0	0.0	3.8
2 Mild interest	-	0.0	4.8	6.1	0.0	0.0	3.8
3 So So/neutral	-	0.0	38.1	33.3	10.5	0.0	26.6
4 Moderate intr	-	0.0	19.0	27.3	42.1	0.0	26.6
5 High interest	-	50.0	28.6	24.2	42.1	0.0	29.1
No response	-	0.0	4.8	6.1	5.3	100.0	10.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of Replies	0	2	21	33	19	4	79

Figure 36. Visitors' responses toward regional scale research as a function of regional issues.

Habitat loss/Oil Spills	1 No interest	2 Mild interest	Regional-scale 3 So So/ neutral	4 Moderate intr	5 High interest	No response	Overall
1 No interest	-	0.0	0.0	0.0	0.0	0.0	0.0
2 Mild interest	-	100.0	0.0	3.0	0.0	0.0	3.8
3 So So/neutral	-	0.0	28.6	21.2	5.6	0.0	17.7
4 Moderate intr	-	0.0	38.1	42.4	33.3	0.0	35.4
5 High interest	-	0.0	28.6	33.3	61.1	0.0	35.4
No response	-	0.0	4.8	0.0	0.0	100.0	6.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of Replies	0	2	21	33	18	4	79

Figure 37. Visitors' responses for regional scale research as a function of regional issues.

Biodiversity/Endan. Spec.	Ecosystem & animal scale 1 No interest	2 Mild interest	3 So So/ neutral	4 Moderate intr	5 High interest	No response	Overall
1 No interest	-	0.0	0.0	0.0	0.0	16.7	1.3
2 Mild interest	-	0.0	16.7	0.0	0.0	0.0	2.5
3 So So/neutral	-	33.3	41.7	23.3	7.1	16.7	20.0
4 Moderate intr	-	33.3	25.0	36.7	10.7	0.0	22.5
5 High interest	-	33.3	16.7	40.0	78.6	0.0	46.3
No response	-	0.0	0.0	0.0	3.6	66.7	6.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of Replies	0	3	12	30	28	6	80

Figure 38. Visitors' responses toward Real scale research as a function of real scale issues.

Pollution & Diseases	Microscopic-scale 1 No interest	2 Mild interest	3 So So/ neutral	4 Moderate intr	5 High interest	No response	Overall
1 No interest	0.0	0.0	3.8	0.0	0.0	0.0	1.3
2 Mild interest	0.0	0.0	3.8	8.7	0.0	0.0	3.8
3 So So/neutral	0.0	50.0	19.2	17.4	6.7	14.3	18.8
4 Moderate intr	0.0	50.0	34.6	47.8	40.0	0.0	37.5
5 High interest	100.0	0.0	34.6	26.1	46.7	28.6	31.3
No response	0.0	0.0	3.8	0.0	6.7	57.1	7.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of Replies	1	8	26	23	15	7	80

Figure 39. Visitors' responses to Microscopic scale research as a function of their responses to micro-level issues.

Social Group	Day of week: Weekday	Weekend day	Overall
Family	29.4	46.5	41.7
All adult group	58.8	53.5	55.0
School group	11.8	0.0	3.3
Total	100.0	100.0	100.0
Number of Replies	17	43	60

Figure 40. Social groups as a function of day of the week.

Home Residence	Day of week: Weekday	Weekend day	Overall
Lincoln County	5.9	16.3	13.3
Corvaillas/5 county area	23.5	23.3	23.3
Portland and vicinity	23.5	20.9	21.7
Other Oregon	23.5	14.0	16.7
Northwest US & BC	17.6	14.0	15.0
Other US	5.9	9.3	8.3
Foreign	0.0	2.3	1.7
Total	100.0	100.0	100.0
Number of Replies	17	43	60

Figure 41. Home residence as a function of day of the week.

Home Residence	Previous visitation: First time	Once every few years	1-2 per year	3+ per year	Overall
Lincoln County	0.0	11.1	22.2	40.0	13.3
Corvaillas/5 county area	8.7	22.2	44.4	40.0	23.3
Portland and vicinity	30.4	16.7	11.1	20.0	21.7
Other Oregon	30.4	16.7	0.0	0.0	16.7
Northwest US & BC	17.4	22.2	11.1	0.0	15.0
Other US	8.7	11.1	11.1	0.0	8.3
Foreign	4.3	0.0	0.0	0.0	1.7
Total	100.0	100.0	100.0	100.0	100.0
Number of Replies	23	18	9	10	60

Figure 42. Home residence as a function of previous visitation.

Science/marine knowledge	Social Group: Family	All adult group	School group	Overall
High	16.0	33.3	0.0	25.0
Moderate	32.0	33.3	50.0	33.3
Low/none	52.0	33.3	50.0	41.7
Total	100.0	100.0	100.0	100.0
Number of Replies	25	33	2	60

Figure 43. Background knowledge as a function of social group.

Home Residence	Science/marine knowledge: High	Moderate	Low/none	Total	Number of Replies
Lincoln County	37.5	25.0	37.5	100.0	8
Corvaillas/5 county area	14.3	42.9	42.9	100.0	14
Portland and vicinity	23.1	38.5	38.5	100.0	13
Other Oregon	0.0	20.0	80.0	100.0	10
Northwest US & BC	44.4	33.3	22.2	100.0	9
Other US	40.0	40.0	20.0	100.0	5
Foreign	100.0	0.0	0.0	100.0	1
Overall	25.0	33.3	41.7	100.0	60

Figure 44. Prior knowledge as function of home residence.

Science/marine knowledge	Previous visitation: First time	Once every few years	1-2 per year	3+ per year	Overall
High	21.7	22.2	22.2	40.0	25.0
Moderate	34.8	27.8	44.4	30.0	33.3
Low/none	43.5	50.0	33.3	30.0	41.7
Total	100.0	100.0	100.0	100.0	100.0
Number of Replies	23	18	9	10	60

Figure 45. Prior knowledge as a function of previous visitation.

Why attend HMSC	Previous visitation: First time	Once every few years	1-2 per year	3+ per year	Overall
Attend when in area	8.7	55.6	44.4	0.0	26.7
Curious/heard about it	47.8	5.6	0.0	0.0	20.0
Love it/come often	0.0	11.1	22.2	20.0	10.0
Attend special event	0.0	0.0	22.2	20.0	6.7
Bring children	17.4	16.7	0.0	30.0	16.7
Bring adult	4.3	5.6	22.2	0.0	6.7
A stop on coast tour	39.1	16.7	0.0	0.0	20.0
Learn specific info	13.0	0.0	11.1	0.0	6.7
Research interest	4.3	5.6	0.0	0.0	3.3
See octopus,etc.	0.0	0.0	11.1	20.0	5.0
Interest marine	13.0	27.8	22.2	0.0	16.7
Other	17.4	11.1	11.1	20.0	15.0
Total	*	*	*	*	*
Number of Replies	23	18	9	10	60

Note: * Multiple answers allowed.

Figure 46. Reasons for attending the HMSC as a function of previous visitation.

Why attend HMSC	Social Group: Family	All adult group	School group	Overall
Attend when in area	32.0	24.2	0.0	26.7
Curious/heard about it	8.0	30.3	0.0	20.0
Love it/come often	12.0	9.1	0.0	10.0
Attend special event	12.0	3.0	0.0	6.7
Bring children	32.0	0.0	100.0	16.7
Bring adult	4.0	9.1	0.0	6.7
A stop on coast tour	8.0	30.3	0.0	20.0
Learn specific info	4.0	6.1	50.0	6.7
Research interest	0.0	6.1	0.0	3.3
See octopus,etc.	8.0	3.0	0.0	5.0
Interest marine	8.0	24.2	0.0	16.7
Other	8.0	21.2	0.0	15.0
Total	*	*	*	*
Number of Replies	25	33	2	60

Note: * Multiple answers allowed.

Figure 47. Reasons for attending the HMSC as a function of social group.

What like best	Social Group: Family	All adult group	School group	Overall
Octopus	64.0	24.2	50.0	41.7
Tidal pool	44.0	15.2	0.0	26.7
Fish tanks	64.0	27.3	50.0	43.3
Hands-on	32.0	12.1	0.0	20.0
Whale exhibit	12.0	15.2	0.0	13.3
Plate techtonics	0.0	3.0	0.0	1.7
Films	0.0	3.0	0.0	1.7
Special events	12.0	6.1	0.0	8.3
Volunteers/docents	0.0	9.1	0.0	5.0
All/general	32.0	48.5	50.0	41.7
Other	12.0	12.1	0.0	11.7
Total	*	*	*	*
Number of Replies	25	33	2	60

Note: * Multiple answers allowed.

Figure 48. Exhibits and displays visitors most enjoyed as a function of social group.

What like best	Science/marine knowledge High	Moderate	Low/none	Overall
Octopus	40.0	35.0	48.0	41.7
Tidal pool	26.7	25.0	28.0	26.7
Fish tanks	60.0	35.0	40.0	43.3
Hands-on	20.0	10.0	28.0	20.0
Whale exhibit	20.0	15.0	8.0	13.3
Plate techtonics	6.7	0.0	0.0	1.7
Films	6.7	0.0	0.0	1.7
Special events	13.3	5.0	8.0	8.3
Volunteers/docents	13.3	0.0	4.0	5.0
All/general	13.3	55.0	48.0	41.7
Other	6.7	15.0	12.0	11.7
Total	*	*	*	*
Number of Replies	15	20	25	60

Note: * Multiple answers allowed.

Figure 49. Exhibits and displays visitors most enjoyed as a function of prior knowledge.

Aware of research	Home Residence Lincoln County	Corvallas/5 county area	Portland and vicinity	Other Oregon	Northwest US & BC	Other US	Foreign	Overall
Yes	87.5	64.3	69.2	10.0	55.6	80.0	100.0	60.0
Vaguely	12.5	14.3	0.0	20.0	33.3	0.0	0.0	13.3
No	0.0	21.4	30.8	70.0	11.1	20.0	0.0	26.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of Replies	8	14	13	10	9	5	1	60

Continued...

Figure 50. Whether visitors were aware of the research purpose of the HMSC as a function of home residence.

Aware of research	Previous visitation First time	Once every few years	1-2 per year	3+ per year	Overall
Yes	34.8	66.7	77.8	90.0	60.0
Vaguely	8.7	22.2	11.1	10.0	13.3
No	56.5	11.1	11.1	0.0	26.7
Total	100.0	100.0	100.0	100.0	100.0
Number of Replies	23	18	9	10	60

Figure 51. Whether visitors were aware of the research purpose of the HMSC as a function of previous visitation.

Attitude re research	Social Group: Family	All adult group	School group	Overall
Very interested	0.0	21.2	0.0	11.7
Interested	16.0	24.2	100.0	23.3
Qualified interest	28.0	39.4	0.0	33.3
Neutral	20.0	9.1	0.0	13.3
No interest/ negative	36.0	6.1	0.0	18.3
Total	100.0	100.0	100.0	100.0
Number of Replies	25	33	2	60

Figure 52. Visitors' attitudes towards research as an exhibit/ display focus as a function of social group.

Attitude re research	Previous visitation: First time	Once every few years	1-2 per year	3+ per year	Overall
Very interested	17.4	11.1	11.1	0.0	11.7
Interested	26.1	16.7	11.1	40.0	23.3
Qualified interest	21.7	38.9	44.4	40.0	33.3
Neutral	17.4	11.1	22.2	0.0	13.3
No interest/negative	17.4	22.2	11.1	20.0	18.3
Total	100.0	100.0	100.0	100.0	100.0
Number of Replies	23	18	9	10	60

Figure 53. Visitors' attitudes toward research as an exhibit/display focus as a function of previous HMSC visitation.

Attitude re research	Aware of research: Yes	Vaguely	No	Overall
Very interested	13.9	25.0	0.0	11.7
Interested	22.2	12.5	31.3	23.3
Qualified interest	36.1	37.5	25.0	33.3
Neutral	5.6	25.0	25.0	13.3
No interest/ negative	22.2	0.0	18.8	18.3
Total	100.0	100.0	100.0	100.0
Number of Replies	36	8	16	60

Figure 54. Visitors attitude toward research topic/theme as a function of whether they were aware of the research purpose of the HMSC.

Attitude re research	Science/marine knowledge High	Moderate	Low/none	Overall
Very interested	33.3	5.0	4.0	11.7
Interested	6.7	40.0	20.0	23.3
Qualified interest	53.3	30.0	24.0	33.3
Neutral	0.0	0.0	32.0	13.3
No interest/negative	6.7	25.0	20.0	18.3
Total	100.0	100.0	100.0	100.0
Number of Replies	15	20	25	60

Figure 55. Visitors' attitudes toward the topic/theme of research as a function of their prior knowledge.

Research Areas	Social Group Family	All adult group	School group	Overall
Envir/conservation	20.0	33.3	50.0	28.3
What are projects	4.0	33.3	0.0	20.0
Why study what do	4.0	18.2	50.0	13.3
The ship	4.0	0.0	0.0	1.7
Whale research	4.0	21.2	0.0	13.3
Animal research	20.0	21.2	50.0	21.7
Sea lions research	0.0	6.1	0.0	3.3
Gen. geology/ geography	4.0	9.1	0.0	6.7
Tsunamis/wave action	12.0	6.1	0.0	8.3
Plate techtonics	0.0	3.0	0.0	1.7
Resource management	0.0	6.1	0.0	3.3
Fisheries/fishing	4.0	9.1	0.0	6.7
Effects of policy	0.0	9.1	50.0	6.7
Animal behaviors	0.0	12.1	50.0	8.3
Particular habitat	8.0	12.1	50.0	11.7
Connect to real coast	20.0	21.2	0.0	20.0
No specifics	44.0	15.2	50.0	28.3
Total	*	*	*	*
Number of Replies	25	33	2	60

Note: * Multiple answers allowed.

Figure 56. Specific research topics of interest to visitors as a function of social group.

Research Areas	Science/marine knowledge High	Moderate	Low/none	Overall
Envir/conservation	26.7	40.0	20.0	28.3
What are projects	33.3	15.0	16.0	20.0
Why study what do	26.7	15.0	4.0	13.3
The ship	0.0	5.0	0.0	1.7
Whale research	26.7	15.0	4.0	13.3
Animal research	13.3	20.0	28.0	21.7
Sea lions research	6.7	5.0	0.0	3.3
Gen. geology/geography	13.3	5.0	4.0	6.7
Tsunamis/wave action	0.0	5.0	16.0	8.3
Plate techtonics	6.7	0.0	0.0	1.7
Resource management	6.7	5.0	0.0	3.3
Fisheries/fishing	13.3	10.0	0.0	6.7
Effects of policy	6.7	10.0	4.0	6.7
Animal behaviors	6.7	20.0	0.0	8.3
Particular habitat	6.7	20.0	8.0	11.7
Connect to real coast	13.3	15.0	28.0	20.0
No specifics	6.7	25.0	44.0	28.3
Total	*	*	*	*
Number of Replies	15	20	25	60

Note: * Multiple answers allowed.

Figure 57. Specific research topics of interest to visitors as a function of prior knowledge of science.

Research Areas	Home Residence: Lincoln County	Corvallas/5 county area	Portland and vicinity	Other Oregon	Northwest US & BC	Other US
Envir/conservation	0.0	28.6	23.1	40.0	33.3	60.0
What are projects	25.0	21.4	15.4	40.0	11.1	0.0
Why study what do	0.0	14.3	23.1	0.0	22.2	20.0
The ship	0.0	7.1	0.0	0.0	0.0	0.0
Whale research	25.0	7.1	7.7	10.0	33.3	0.0
Animal research	25.0	14.3	23.1	30.0	11.1	40.0
Sea lions research	0.0	0.0	0.0	10.0	11.1	0.0
Gen. geology/geography	25.0	0.0	7.7	10.0	0.0	0.0
Tsunamis/wave action	25.0	7.1	0.0	20.0	0.0	0.0
Plate techtonics	0.0	0.0	7.7	0.0	0.0	0.0
Resource management	0.0	0.0	0.0	10.0	0.0	20.0
Fisheries/fishing	0.0	7.1	0.0	10.0	11.1	20.0
Effects of policy	0.0	0.0	7.7	20.0	0.0	20.0
Animal behaviors	0.0	0.0	7.7	10.0	22.2	20.0
Particular habitat	12.5	0.0	15.4	20.0	11.1	20.0
Connect to real coast	25.0	14.3	15.4	10.0	33.3	40.0
No specifics	12.5	28.6	53.8	30.0	11.1	0.0
Total	*	*	*	*	*	*
Number of Replies	8	14	13	10	9	5

Continued...

Research Areas	Foreign	Overall
Envir/conservation	0.0	28.3
What are projects	0.0	20.0
Why study what do	0.0	13.3
The ship	0.0	1.7
Whale research	0.0	13.3
Animal research	0.0	21.7
Sea lions research	0.0	3.3
Gen. geology/geography	0.0	6.7
Tsunamis/wave action	0.0	8.3
Plate techtonics	0.0	1.7
Resource management	0.0	3.3
Fisheries/fishing	0.0	6.7
Effects of policy	0.0	6.7
Animal behaviors	0.0	8.3
Particular habitat	0.0	11.7
Connect to real coast	0.0	20.0
No specifics	100.0	28.3
Total	*	*
Number of Replies	1	60

Note: * Multiple answers allowed.

Figure 58. Specific research topics of interest to visitors as a function of their home residence.

Response to 4-scales	Social Group: Family	All adult group	School group	Overall
Very positive	0.0	27.3	0.0	15.0
Positive	32.0	33.3	50.0	33.3
Neutral	20.0	15.2	0.0	16.7
Negative	20.0	3.0	0.0	10.0
None/no comment	28.0	21.2	50.0	25.0
Total	100.0	100.0	100.0	100.0
Number of Replies	25	33	2	60

Figure 59. Visitors' attitudes toward the four scales of research theme as a function of social group.

Response to 4-scales	Aware of research: Yes	Vaguely	No	Overall
Very positive	16.7	25.0	6.3	15.0
Positive	33.3	37.5	31.3	33.3
Neutral	22.2	12.5	6.3	16.7
Negative	8.3	12.5	12.5	10.0
None/no comment	19.4	12.5	43.8	25.0
Total	100.0	100.0	100.0	100.0
Number of Replies	36	8	16	60

Figure 60. Visitors' attitudes toward the four scales of research theme as a function of their awareness of the research purpose of the HMSC.

Response to 4-scales	Science/marine knowledge High	Moderate	Low/none	Overall
Very positive	20.0	25.0	4.0	15.0
Positive	40.0	35.0	28.0	33.3
Neutral	20.0	20.0	12.0	16.7
Negative	6.7	10.0	12.0	10.0
None/no comment	13.3	10.0	44.0	25.0
Total	100.0	100.0	100.0	100.0
Number of Replies	15	20	25	60

Figure 61. Visitors' attitudes towards the four scales of research theme as a function of their prior knowledge of science.

Attitude re research	Response to 4-scales Very positive	Positive	Neutral	Negative	None/no comment	Total	Number of Replies
Very interested	42.9	42.9	0.0	0.0	14.3	100.0	7
Interested	21.4	50.0	7.1	0.0	21.4	100.0	14
Qualified interest	15.0	40.0	30.0	10.0	5.0	100.0	20
Neutral	0.0	25.0	12.5	0.0	62.5	100.0	8
No interest/negative	0.0	0.0	18.2	36.4	45.5	100.0	11
Overall	15.0	33.3	16.7	10.0	25.0	100.0	60

Figure 62. Visitors' attitudes toward the four scales of research theme as a function of their attitude toward research as an exhibit/display focus.

Appendix A

Hatfield Marine Science Center
First Workshop
Aldrich/Pears Associates offices

Communications Planning Phase
Friday, April 15, 1994
1573 East Pender Street, Vancouver

Agenda

1.0	Introduction - Goals and intended outcomes of the workshop	9:00 - 9:15
2.0	Mission, Goals and Objectives - The role of HMSC's public wing - Opportunities and challenges	9:15 - 9:30
3.0	Discussion of Target Audience - Whom do we want to reach? - What are the implications for the communication strategy?	9:30 - 9:45
4.0	Process - Review of research to date - Our approach to sorting the results - Criteria for selecting a theme	9:45 - 10:00
5.0	Presentation of Thematic Approach - Some possible themes and organizing principles - Proposed theme and thematic structure	10:00 - 10:30
break		*10:30 - 10:45*
6.0	Presentation of Design Approach - exhibit and design elements flowing from thematic approach	10:45 - 11:15
7.0	Open Discussion and Idea Session - Brainstorming session to flesh out thematic structure - Exhibit and program ideas - Feature research ideas: looking for good examples and additional research projects to include	11:15 - 2:15 *(lunch during)*
8.0	Architectural Issues - Site issues, theater, aquaria, space requirements, etc.	2:15 - 3:00
9.0	Evaluation Issues - John Falk - Discussion of the goals of and approach to evaluation	3:00 - 3:15
10.0	Summary and Next Steps - NASA process - Requirements of Congress - Draft Communications Plan	3:15 - 4:00

HATFIELD MARINE SCIENCE CENTER
DRAFT THEMATIC APPROACH

Some Definitions

Patterns: *A complex of integrated parts functioning as a whole.*
...a representative example, sample or instance.
..an original or model proposed for imitation.

Complex: *Consisting of numerous or diverse parts; so elaborate as not to be easily understood.*

Application: *Capacity of being used; relevance.*

Consequences: *The relation of an effect to its cause.*

Scientific Method: *A method of inquiry depending upon the reciprocal interplay of observable data and generalizations. It consists typically of the statement of a problem and the accumulation and analysis of relevant data that may lead to the construction of a hypothesis, in turn tested by the reliability and accuracy of deductions from it and by its consistency with other hypotheses and observed data.*

Problem Analysis

The objective of the HMSC visitor center is to educate visitors with regard to: science and the scientific method; the importance of scientific research; and the importance and quality of research being undertaken at this facility and at the main campus of Oregon State University. Visitors should leave the center with an appreciation of the value of the research done at this institution—and by scientists generally—and an understanding of the relevance of this work to their lives.

Two general considerations will guide the selection of stories. First, precedence will be given to stories relating to the marine environment reflecting HMSC's location and primary research direction. Second, stories related to remote sensing for scientific purposes will receive extra consideration for interpretation and education.

Thematic Opportunities:

A number of public and private facilities provide exhibitry and education on elements of the marine environment, from marine organisms to oceanography. These facilities, however, almost always distribute information that was collected elsewhere by others. HMSC is in the unique position of being the "real" thing – a research facility with real scientists doing real research. This fact helps guide the visitor experience by providing HMSC with a unique character and potential experience.

This is an important opportunity. HMSC should not, in its exhibitry and public programs, sacrifice its status as one of the country's leading research facilities. It is an institute for higher learning and research into issues that affect the well-being of all of us. The opportunity to convey this status should override any temptation to oversimplify. Visitors are always most impressed and affected by contact with the real thing.

Thematic Challenges:

Real science is complex; lay people may find it esoteric and abstruse. Similarly, the range of research projects at HMSC covers a wide variety of topics. This is as it should be: real life is complex and the needs for research in science alone cover a great spectrum of subjects. The challenge is to bring this complexity to life without overwhelming visitors either by failing to appropriately interpret this complexity in a way that is meaningful to them, or by simply including more information and detail than a casual visitor could be expected to absorb...or want to absorb.

The Process:

To date we have interviewed 25 scientists with regard to approximately 40 research projects. Other scientists will be interviewed over the coming weeks. In reviewing these interviews, we looked for differences that would allow us to group the research projects and for common threads to connect them.

Possible Groupings:

Scale: while the scientists we interviewed worked at a variety of scales there were certain obvious "clusters". Many looked at the big picture from satellites to sonabouys. Others conducted their studies on a scale that could be marked on a typical small scale topographic map or hydrographic chart. Another cluster of researchers work at the 1:1 scale while others need the magnification provided by microscopes or ESMs. Only a very few mixed scales.

Questions: Clustering was less obvious when research projects were analyzed in terms of questions to be answered. A further problem resulted from attempts to paraphrase the research goals into questions. Oversimplification of the question produced questions that were too vague – almost any agency or institution could be said to be trying to answer these questions. On the other hand, overly detailed questions provided no clear tool for organization and tended to suggest that all the research was unrelated.

Tools: Some interesting patterns appeared when we considered the tools that researchers use. Virtually all research required or benefited from computers – for some this was the only tool. Many researchers used video either as an integrated element in their data collection and analysis, or as a tool for documenting their work. Satellites are an important source of data for perhaps 20% of the studies. GIS was integral to a number of resource management studies. A number of studies used tools which are still in the development and refinement stage but which may ultimately have a significant effect on scientific research in a number of fields. Few studies are laboratory based.

Links To Other Researchers: Connections between researchers was also less clear a method of organizing the projects into a cohesive thematic structure. Relatively few scientists work directly with others at HMSC; their research linkages often extend outside to other agencies or researchers in many locations. While this is an important story element—i.e. the universality of science—it is unsatisfactory as an organizational tool.

Applications: How the research is used provides some structure to our organization. Some research at HMSC is *very* applied, i.e. it is used directly for decision-making, usually with regard to resource management. At the other end of the continuous spectrum are what we have arbitrarily called basic research: studies which provide a database from which other studies will be needed before any direct application can be attempted. In between these two are the *other* studies – those which are intermediate in their applicability to decision-making, the final goal for much of our science. Two other research endeavors were noteworthy because they stand somewhat separate from all of the others. One is the exploration of the role of Chaos in all of science generally. The other involves examining the way decisions are made and consequently how the science is applied.

Consequences: We use this term to mean the implications of science for peoples' lives, i.e. "how does this affect me?". Certain groupings came naturally. Many research projects have direct economic implications for people either with regard to jobs, or to the cost of goods and services they must purchase. Related to these implications are environmental consequences; science which attempts to maintain or restore the health of the planet's ecosystems and therefore the quality of life for all of us who depend on these systems.

Others: Other approaches were considered and tested but were dismissed, usually because they failed to provide or assist in organizing the research into a thematic structure. Such approaches included organizing the science by discipline (i.e. physical oceanography, neurophysiology, etc.), and by issue (e.g. economics, environmental concerns, etc.).

PROPOSED STRUCTURE:

Having weighed each of the options for grouping research projects into exhibit sections, we found "the scales at which research is undertaken" to be the most appropriate, for the following reasons:

- As an organizing tool it allows for balanced grouping of information, and it offers visitors an unexpected angle on scientific research, one that doesn't rely on academic disciplines or specific topics.

- It most easily permits categorization of seemingly disparate research with the least redundancy. Most researchers work at one of relatively few scales (e.g. satellite, microscope, etc.) while few researchers work at two or more different scales (or at least equally at different scales).

- Flexibility: while individual researchers may leave the program and specific projects will end, it is probable that there will always be scientists working at the different scales

- It provides an intuitively reasonable way of looking at complexity – start with the big picture (from far away) and gradually get closer for additional details or, alternatively, start close-up at high resolution and back away to achieve a broad perspective.

- Symmetry: scale lets us look at very different processes and phenomena in very similar ways by changing scale. For example, graphs of undersea vent activities are superficially similar in appearance to graphs of ion channel activity within a single cell.

Though scale offers a way of distinguishing research types, we still sought a way of connecting them - a common theme that would make sense of such diverse research activities , from studying pollock behavior to exploring chaos.

PROPOSED THEME

We propose that the theme for the Hatfield Marine Science Center be:

Searching for Patterns in a Complex World

Rationale for Overall Theme:

Science can be described as a search for patterns. "Scientific patterns" refers to observable data that permits accurate prediction of future events. Identifying a pattern means that the structure can be understood to the extent necessary for decision-making. For example, this set of observable phenomena precedes the development of violent storm conditions; therefore in the interests of public safety, certain actions must be taken.

Patterns also provide a motif or image that could be included in exhibitry. Many of the research projects—often with the aid of computers—capture physical phenomena in images that approach art in their form, colors and power.

It is essential that visitors understand the complexity of the challenges that science faces, hence the inclusion of "...in a complex world". Many visitors may react to the complexity of the world at a visceral level. The world is too complex to be known or understood. Scientists also find the world complex. They too may react to this complexity emotionally but primarily—and professionally—they view it at an intellectual level. A role for the public wing is to relate this view of complexity to the visitors by introducing them to the process of science.

RESULTING THEMATIC FRAMEWORK:

Using the search for patterns as common element throughout, we propose the following framework for exhibits.

Thematic Sections

Global Scale

Global scale studies require distance for pattern detection e.g. ocean currents, vents, climate. We define global scale research as research which requires a globe or similar scale map to show study areas e.g. ≥1:2,000,000. Common concepts which might be introduced at this scale include climate and weather, ocean currents, plate tectonics, and ocean productivity. Familiar issues that require research at this scale include global warming, ozone depletion and phenomena such as El Nino.

Bird's Eye

"Bird's Eye" studies are characterized by a research that can be located on a small scale topographic map or hydrographic chart, e.g. a state map (e.g. 1:500,000). While pattern detection is most easily achieved at this scale "ground-truthing" is possible. The role of geographical information systems is a concept which may be introduced here. Many environmental and economic issues such as fisheries, oil spills, habitat loss and pollution are studied at this scale.

Eye Level

We have termed research that takes place at our *real* scale of 1:1 as being at eye level. At this scale, pattern detection is possible with the unaided human eye. Important concepts that may be introduced at this scale are ecosystems, and the role and relationships of individuals within ecosystems. Some highly-publicized issues such as endangered species and biodiversity are commonly studied at this scale.

Microscopic

Research at a scale where pattern detection requires magnification. Pollution and disease are often studied at the microscopic level. An important concept for introduction at this scale is the idea of the body of a single organism as an ecosystem.

Subthemes

Within each scale grouping, the search for patterns is the primary theme, both as a reminder of the goal of science and as a graphic element. Other common elements, or subthemes, include:

Tools

The technology that allows us to detect patterns at different scales will be a key element throughout the exhibits, particularly remote sensing technology.

Scientific Method

The scientific method will be another repeated element throughout the exhibit. Perhaps introduced in the orientation area, the terms and structure of the process will be included in each exhibit element.

Chaos Theory

Chaos theory provides some wonderful exhibit opportunities as a result of the beautiful and powerful images that are often used to express the theory, and, because it serves as a reminder that science is not a known quantity – it is the sum of knowledge at a particular moment in time. Chaos theory reminds us that humility is always in order in science, and, that new theories are always in development. Some will end up in the delete bin while others—like evolution and plate tectonics—will change the way we look at our planet forever...or at least until a better theory comes along. We propose to include basic elements and examples of Chaos theory at appropriate points in the storyline.

Questions

When presenting a research project, exhibits should identify the questions the researcher is seeking to answer, in terms visitors can understand.

Field

Though not an organizing principle for the exhibits, academic disciplines can be touchstones for visitors. Exhibits should help visitors grasp specific research by relating it to a recognizable field of research such as physical oceanography or fisheries biology.

Links to other researchers

Wherever possible, exhibits should reveal the connections between diverse fields of research - scientists sharing data, tools, or ideas across the boundaries of their discipline.

Consequences

Much of the research at OSU has direct of indirect implications for decision-making. Other research looks at the way people make decisions based on science and on many other factors. HMSC's public wing can be a very important reminder that decisions must be made and that these decisions will often be made by lay people, like our visitors, with scientists acting as advisors only. This "human element " can be termed the applications and consequences of science. Exhibits will need to relate research activities to the concerns of the general public -- global warming, El Nino, decline of the salmon -- making science relevant and important in the minds of the visitors.

Appendix B

MEETING SUMMARY
Meeting of Design Advisory Committee
September 8, 1993
HMSC Guin Library

INTRODUCTION TO PROJECT TEAM:

Lavern Weber - Director, HMSC
Jan Auyong - NASA Project Manager
William Hanshumaker - HMSC Marine Educator
Parker Henchman - HMSC Facilities Manager
George Keller - Vice President, Research & Graduate Studies
George Mpitsos - Professor, Pharmacy
Jon Root - Director, Communications Media Center, OSU Ed-Net
Ted Strub/Mark Abbott - Associate Professors, Oceanography
George Taylor - State Climatologist
Jerry Watson - University Architect

PROJECT OBJECTIVES:

Overall: To interpret to school groups and individuals why and how the ocean is studied and why this is important to everyday life.

Subset:
- To update and expand existing educational facilities and programs to communicate research processes and the results of marine research conducted by OSU and cooperating agencies and to promote wise stewardship;
- To inform the public about global issues with specific information about the influence of the ocean on the earth;
- To provide school children, teachers/educators, the general public, and scientific researchers access to remote sensing data in real time as well as archival form;
- To showcase and test new technologies related to multi-media and interactive exhibits, distance learning and telecommunications

EXPECTED MEETING OUTCOMES:

The meeting will be used to generate an initial array of possible program themes, scientific concepts, research techniques and processes which will be given to prospective project consultants (the short list). This summary will also be used as the foundation for future interactions between the Design Advisory Committee and the chosen consulting team.

PROJECT PARAMETERS:

(Please refer to the Background Paper for proposed interpretive facility and program parameters and consultant selection criteria.)
Additionally, the entryway must:

- set the tone for the entire facility
- funnel people into the displays at a 'controlled' speed
- orient people on what to expect so that they get the most out of the coming displays

Important criteria:

- dynamic
- diverse
- flexible
- excitement generation

SECTIONS THAT FOLLOW INCLUDE:

THEMATIC BRAINSTORMING SESSION:

THEMES:

How we learn or study

* How we learn from afar (including remote sensing)
* What tools are used (space satellite sensing, ocean sensors, ocean craft, observations/history)
* Science as a way of knowing (theme is process, rather than content, oriented)
  - there are lots of ways of knowing, but science brings some special rules
    e.g., replicability

Interrelatedness of systems and man's role

* Linkages between atmosphere and biology, e.g., heart function
* Interactions of life histories with the physical environment
* Interrelatedness of everything
* We respond to inputs, often of a global scale
* Studying complex systems at various levels and at various time and spatial scales
  - understand behaviors and reactions to complex systems
  - describe individual components and look at interaction of parts
* Man is only one part of an inter-related, complex system with long-term natural cycles
  - more and more global issues
  - management cannot occur without understanding
  - long term natural cycles at odds with immediacy of funding system
* Relationship between *Homo sapiens'* "cultural ecology" and the more traditional natural ecology
  - economists and social scientists are now understanding that economics is really a branch of biology
  -conversely, many biologists and ecologists are using economic paradigms to understand behavior of other organisms ("bionomics") besides *Homo sapiens*

Why do we study science or Why do we do research?

* Science is/can be important to the public (examples explain why)
* Science allows us to predict change and adapt
* As global events change our lives, science helps us to accommodate these changes
* Science plays a part in how humans and other organisms respond and cause change
* Scientists help us to understand the earth: change, questions, scale, complexity
* How does it help me, the general public or a target audience
* Society benefits from this activity (examples demonstrate return on its investment)
  "Why should Oregonians support their universities and the research conducted through these?" (... A monetary question is often best answered with a like answer

HMSC is a gateway to the global environment
HMSC is a gateway to knowledge and the ocean

HMSC is at the confluence of sea, sky, land, river/bay

ADDED PARAMETERS FOR EDUCATION PROGRAM:

Follow or use a process orientation that demonstrates how people (scientists) process information and the processes passed through to understand complex ideas, i.e., allow participants to dive into the research or decision-making process and have visitor leave with a skill. Demystify the scientific process Example: water wheel exhibit (Mpitsos)

Avoid message that technology or a technology is an end goal

Have participant consider philosophical, social, practical/nonpractical, economic reasons

Theme must be able to embrace a wide variety of research subjects without attempting to force them into some sort of forced interrelationship

DESIRED OUTCOMES OF EDUCATIONAL PROGRAM:

People understand why science is important

Example: now can sometimes predict where and when earthquakes occur

Example: better knowledge of fisheries

Enhance people's understanding of the scientific process

Improve the public's image of scientist and science

Have people understand why and where research questions arise.

Change requires study and science can help people to understand and accommodate change

Have people understand why there is a need to study the environment and resources and use this understanding to explain other thought processes/knowledge

Attempt to explain scientific method so that people can distinguish between science and pseudoscience. Communicate the difficulty of knowing anything absolutely.

ONE POSSIBLE FLOW OF IDEAS (science as a way of knowing)

Basic idea:

human action (or inaction) lead to consequences, i.e., outcomes either positive or negative
- e.g., changing population patterns, timber harvests, etc.

what happens when we fail to know or understand what these consequences are
- i.e., what kinds of costs are incurred and who bears them

Exhibits that allow people to play "what if" games would allow communicating consequences as well as the effects of alternative solutions.
- e.g, what happens when fishery resources are overharvested
- e.g., what happens when solutions such as restrictions, artifical stocks, etc. are attempted

Capitalize on the ability of the center to serve as a place where people learn and to show how the particular laearning form of science is critical for living in a world of increasing demands, global affects, and constrained choices. Message: science serves the needs and interests of society, albeit at times, this relationship is less obvious than others, such as with much basic research. Nevertheless, the benefits of science accrue to people. Thus, inform people as to what science has done for them [or as someone said, "cultivate willing buyers of science"]

SUPPLEMENTAL OBSERVATIONS AND COMMENTS (post-meeting offerings)

BASIC CONCEPTS

Homeostasis
Symbiosis
Molecular biology techniques

WAY TO UNIFYING OR INTEGRATING DIFFERENT IDEAS/CONCEPTS

The terms sociological, economics, interdisciplinary, unifying, and global were common among the different groups. Adynamic marine policy problem linking social and natural siciences with global market and environmental issues would be a good vehicle for integrating these concepts.

MARKET/PROGRAM ANALYSIS

-evaluate results of other programs and centers

e.g., response to interactive exhbitis; how much was learned; how to adapt exhibits

SUBCOMMITTEE DISCUSSION SUMMARIES

Aquaculture/Fisheries/Seafood

Forest Resources/Trends & Hydrology

Nearshore & Coastal Processes & Habitats

Open/Deep Ocean Processes & Habitats

Atmospheric/Climate

Organismic & Cellular/Subcellular

AQUACULTURE/FISHERIES/SEAFOOD

BROAD CONCEPTS

What Is The Scientific Method?
- How are hypotheses formulated and studied, i.e., help people understand how science is done.
- Contrast scientific and non-scientific approaches
- Possible problems/questions to use as examples:
  - why do animals gather on edges?
  - why did the Peruvian anchovy population collapse?
  - why does the needle disease in Dungeness crab appear where it does?
  - how does Japanese preference for dark, oily fish affect markets and fishery management?

Long-Term Studies Are A Powerful Means Of Doing Science
- Show inter-connections between local systems and global events
  - Livingston's study of Gulf and Appalachicola Bay
- Cutting edge stuff and just beginning to use/to see connections

Examine or Show How Management Decisions Are Made
- Choices and trade-offs
- Use interactive game for making fishery management decisions
- Examples:
  - work of Carl Walters (games with fishermen to develop management schemes)
  - work at UW with adapting CRISP program for use with children

Demonstrate Effects Of Man-Made Actions On Natural Resources
- e.g., Dams on the Columbia
- e.g., Dumping sewage sludge and effect on benthos

Link Global Events With Biological Cycles
- Consider time scales and cycling
- Possible issues:
  - salmon population & ocean conditions & atmospheric changes <Pearcy's work>
  - island deforestation & coral reef ecology <Haiti>
  - El Nino & fisheries
  - primary productivity

Other Linkages to Explore
- Interrelationship of species
  - harvesting pollock & sea lions & Bering Sea productivity & fishery changes

SPECIFIC CONCEPTS

Shellfish Aquaculture In Oregon
- Present history, biology, habitat, pollution and water quality, user conflicts
- Consider man's effect on species
- Role of genetics

Salmon Life Cycle
- For example, coastal coho
  - demonstrate biology
  - show human impact on cycle
  - demonstrate global events impact
- Look at life cycle from salmon point-of-view

Looking At Fish Species
Whiting and other groundfish
Use of SST with tuna

Look At Dynamics Of Local Fishery Complex
One species thrives while another declines
What about by-catch and discard?

Local Conditions As They Relate To Primary Productivity
Upwelling and fish/bird populations
What are the local conditions? **[annual and longer cycles?]**

Consider Relationship Of Markets/Fishery Management/ Fishing Effort

Other Ideas
Use three groups to compare/contract effects and to demonstrate the following concepts:
- all have pelagic larval that interact with water column
- use groups to explore concept of:
  * primary productivity
  * changes in the water column
  * changes in habitat
- local and global events

Sample groupings: a) pisces, mollusca, crustacean; b) whiting, oyster, Dungeness crab

USES OF REMOTE SENSING AND OTHER INSTRUMENTATION
Develop concept of edges through use of sea surface temperature data
- infrared thermography ....and....SST sensing
- how fishermen use the information
- how scientist use the information

Real-time hurricane tracking
- how public uses the information
- how scientists connect storm data with other biological data
  e.g., menhaden need major storm events
  e.g., blue crab population and major storm events

Use of instrumentation
- how fishermen use in pilot house
- how scientists use in the lab

SHOWCASE SCIENTIST
Have video clips that the public can chose from
- clip would show scientist discussing his/her work & showing what they do in the lab or field

Other program parameters:
Remember we are a marine center
Consider fishermen/fishing industry as a target audience

FOREST RESOURCES/TRENDS & HYDROLOGY

MOST IMPORTANT TOPIC/CONCEPT TO INTERPRET

Ecosystem management - components of the ecosystem are all linked together, and changes/actions in one will affect other components, including the human communities

BASIC QUESTION - WHAT IS IT THAT WE WANT PEOPLE TO LEARN BY USING THE FACILITY

Cycle of nature and the cycle of human life

BASIC CONCEPTS

Effects of forestry/hydrology in people's lives
- linkages of ecosystem
- relationship between forests & seas
  e.g., inter-relatedness
  e.g., functional relationships
- conceptions and misconceptions about resources & change
- renewability v. non-renewability
- hydrology as a link between forests & seas
- connectedness and consequences
- importance of resources to quality of life
  i.e., how environments/resources attract people to live/visit/interact with the natural world
- time scale / ecosystem analysis / long term - large scale
- importance of planning across boundaries
- scope, rate, nature of changes in land use
- consequences of our activities

Natural resource management meets a consumer need
Teach affect of management and natural disturbances on forests
Use computers (especially interactive), satellite photos, visual overlays, etc. to demonstrate
Impacts of tourism, forestry, fishing, etc.
- show human action & trace through environment, social system & economy
- overlay different land-use patterns to show conflicts
- trace flow of dollar through coastal economy, leaks, etc.

APPLIED RESEARCH AREAS

Management of riparian zones
Logging practices
Effects of logging practices on rate & heat flow of streams & water supplies
Impact on economy and social systems, including tourism's impact on the coast
Actions and consequences related to hydrology
Habitat restoration
e.g., streams for salmon
Making forest plantations mimic a natural forest ecosystem

FUTURE DIRECTIONS OF RESEARCH

Understanding "adaptive management" by learning from previous & current behaviors
Landscape/ecosystem management
Adjustment of future actions
More emphasis on integration of disciplines
Consideration of larger space & time scales, as well as political boundaries
Development of institutional structures that allow integration
Harvesting as a result of public policy rather than economic reasons
Ecotourism

PROFESSIONAL ISSUES

Scientific rigor

What is in vogue at this time [consensus on level of or area?]

Decreasing timber sales/tax revenues affects research institutions

Significance of timber funding on other disciplines

** Declining resources/declining dollars for research

PUBLIC SOCIO-ECONOMIC ISSUES

Human values shape resource management (they can define resources)

Misinformation & misunderstanding

Two way communication with wider community

Failure of science to see itself as part of a larger "web"

** How do we get the public's questions? Are the questions the same between science/public?

Actions/consequences

INTERRELATED FIELDS

Ecology, biology

Remote sensing

Climatology

Economics/sociology

USES OF REMOTE SENSING

Determine and track land use patterns

Time series data

Long term stream flow

- really need better ways to interpret & distribute the data we have

** Overlay data among disciplines

OPPORTUNITIES FOR SCHOOL/COMMUNITY GROUPS

Bird population census

"Adopt-a-stream" (clean and monitor)

Environmental/ecological impacts of tourists/recreationalists on sensitive areas, e.g.., parks

Examine changes in their communities over time

EXHIBIT IDEAS/PARAMETERS

Should be interactive

Some form of human interaction, maybe even a constantly changing exhibit with the builder/demonstrator interpreting as the demonstration is being built or changed?

Movement from simple concepts to more complex

- perhaps through video disks

Each participants is also an interpreter

Use of virtual reality equipment/program

Additional Parameters:

Public can deal with complex issues as long as information is not confusing

NEARSHORE & COASTAL HABITATS & PROCESSES

CONCEPTS

- The near shore habitat is "where the rubber hits the road".
  ... take advantage of this habitat in terms of this is where people interact with the ocean
  ... draw the connection with people's experiences as individuals
  ... take advantage of the "reality" of the nearshore because this is where people are as they enter the public wing

- Demonstrate how the nearshore is connected to individual's lives and the value it brings to individuals
  .. this is more than gee whiz ... virtually all seafood is harvested in the nearshore (within 200 miles of the coastline) ... the nearshore is that part of the ocean paying dividends

- Stewardship is of paramount concern.
  ... knowledge and information is fine in itself but our presentation must impact individual's behavior ... make the connection between individual's behavior and the nearshore environment very clear

- Focus on the work of active scientists in the nearshore including geological hazards, other coastsl natural hazards, rocky shores, estuaries [... unfortunately these people had to schedule conflicts that day]
  ... invite the public to the Hatfield Marine Science Center and demonstrate science... ... better yet let the visitor become a part of science in action
  ... avoid selling science

Constraints to be considered:

Because HMSC is built on a wetland:
- there may be constraints on physical development
- the presence of and any further construction for the public wing becomes an educational tool

  although this must be approached cautiously, it might be pointed out that "if we knew then, what we know now" that HMSC might not be sitting on this site and why ... geological hazard, infill of wetlands ...

Additional Comments:

We suggest that you contact Jim Good*, Paul Komar, Jane Lubchenco*, and Deborah Brosnan directly for contribution of their research to the public wing and the tie to information downlinked from the satellite.

Eldon Hout will contribute an additional statement.

* *members of the Design Advisory Committee*

OPEN/DEEP OCEAN HABITATS & PROCESSES

IMPORTANT TOPICS FOR INTERPRETATION
- Recruitment
- How research broaden one's concept(s) of the world

BROAD CONCEPTS

While programs may remain address a particular subject for many years, research is dynamic
- e.g., the VENTS program has existed for over 10 years but topics have changed over time.
  - VENTS in general- looks at impacts of vents on ocean environment
  - Topics have ranged from megaplumes, to deployment of new technology/devices, tc.

Real-time data can be compared to previous time period data, e.g., yesterday, last month, etc.
- Ex. use SOSUS to look at earthquakes much like US Navy warroom follows subs
- Ex. Navy has ability to track whales in real time but capacity not widely distributed

BASIC CONCEPTS

(K-6)
- Heat rises, volumetric measurements
  - e.g., thermoclines

(middle to high school and general public)
- Ocean is vertically stratified, resistant to vertical mixing
- Currents transport heat horizontally
- Wind forces currents
- Convective cells form
- Winds and currents result from solar heating
- By moving vertically, organisms can change the direction of their horizontal transport
- *Middle*: temperature to volume, pressure to temperature
  - e.g., upwelling/currents, why 600 degree water doesn't boil in vent systems
- *Upper*: electromagnetic spectrum, analog modeling
  - e.g., remote sensing devises using the entire range
- *General*: the earth as a system
  - e.g., El Nino: prediction and effect on weather patterns

(college)
- The rotation of the earth changes the direction of the currents, along with horizontal density gradients
- Process of chaos manifesting itself in systems (from cellular to worldwide)

IMPORTANCE OF THESE CONCEPTS
- Because they determine the vertical and horizontal distributions of heat, nutrients & organisms

EXAMPLES THAT DEMONSTRATE THESE CONCEPTS
- Aquarium studies, driven by surface, bottom & side heating
- Computer models to simulate the fluid motion given different forcing
  - interact by specifying wind forcing heating & watch motion
- Place organisms within real ocean model current fields & allow interaction by specifying organism behavior (passive, vertical migration, hiding at depth during storms)

APPLIED RESEARCH AREAS
- Fisheries recruitment
- Hazardous spill movement
- Search & rescue - drift of bodies, wrecks
- Global climate prediction
  - deep ocean circulation effects
- Nutrient budgets and cycles
- Location and prediction of earthquakes and tsumanis for Pacific Northwest

FUTURE DIRECTIONS
- Greater remote sensing,
- Modeling of physics
- Optical, acoustic sensing of organisms

PUBLIC SOCIO-ECONOMIC
- Fisheries management and resource management
- Pollution
- Climate change
- Human populations along coasts

INTERACTIONS AMONG DISCIPLINES
- Atmospheric circulations, air-sea-land, forestry-hydrologic cycles

REMOTE SENSING INFORMATION
- NOAA AVHRR, color
- NASA altimeter, scatterometer (currents, winds-large scale)
- Shore based radar for local currents
- Satellite relayed info from meteorological, current moorings
- Satellite tracked drifters

Devices used:
- buoys, sonar arrays (SOSUS)
- submarines, e.g., Alvin
- satellites
  - e.g., geostationary, polar orbiting, "irridium net" (low orbit w/ global cellular coverage)
- ROV's (remote operated vehicles - tethered)
- AUV's (autonomous underwater vehicles - unattached)
- state-of-the-art computers, workstations, software and graphics

DATA GATHERING/MONITORING BY SCHOOL/COMMUNITY GROUPS
- Associate different school/groups with different locations along coast
  - measure daily or weekly:
    - * surface temperature
    - * sea level
    - * visual character, color
    - * other
  - provide them with (later) wind, tide gauge, other (e.g., AVHRR images)
  - at end of year or twice a year, different groups exchange data and each team develops an analysis of relation between these variables
  - bring them together for a comparison of results
  - RESULT: time series at coastal locations
  - RESULT: experience making sense of data, as well as collecting it
- Have similar groups contact fishing vessels in their area
  - get at-sea temperatures, wind, fish catch, etc.

ATMOSPHERIC/CLIMATE

BASIC CONCEPTS
- Difference between weather and climate
  - examine time scales
  - averages and extremes of weather & climate
- Concept of water cycle
  - rules which govern behavior are covered
  - uses physical models
    - e.g., sponge & water
  - interrelationships between the ocean and the atmosphere
- Global, regional, and local climate change
  - time scales
  - drought conditions
    - * not unique to recent history (0-10 years)
- Upwelling, sea breeze, fog
- Create the El Nino event and watch the effect
  - have visitor make predictions
- Satellite images - what does/do they mean to visitor?
- We do not have all the answers

EFFECTS & INTERRELATIONSHIPS
- on daily lives (activities)
- economics
- time & spatial scales
- health & well being

EXAMPLES THAT COULD BE USED
- Sponge (G. Taylor)
- Computer simulations (interactive/using various modalities)
- Weather on your birthday (this year, when born) (G. Taylor)
  - avoid horoscope analogy
- Sea surface data on your birthday
- Examples of local effects linked to regional effects to national to global
- Feedback loop for DMS (see David Specht)

METHODS THAT CAN BE USED
(recommend use all three levels given below)
- Simple: sponge
- Moderate: interactive programs
- Complex: computer modeling/simulations

- Multimedia (interactive or static) v. interpreting (introducing the topic)
- Gridded data/digital info
- Have CD-ROM./multimedia available to have teachers take back with them
- Visual graphic displays that go from the dynamics of the atmosphere/climate/ocean to the dynamics of human functions (anatomy)

APPLIED RESEARCH
- VENTS project
- Chapman's Research
- Sigleo's work (UVb)
- Mike Bahrenfeld (UV light & plankton)

DATA GATHERING/MONITORING OPPORTUNITIES
- Using Internet (or some other server) for teachers to access info and data
- Annual CD-ROM of images distributed

ORGANISMIC & CELLULAR/SUBCELLULAR

GENERAL DISCUSSION

The Group had a number of comments, suggestions, concerns, etc., that may best be summarized under six interrelated topics:

(1) How science is done and what the public needs to know about its relationship to science.

(2) The fact that we are living in a highly complex environment that is ever changing, and that we ourselves are part of that environment.

(3) The use of models in the doing of science and in understanding (and possibly predicting) the underlying complexity.

(4) How data (often obtained serendipitously) affects the models we develop, and, in turn, how the models determine how we actually perceive ourselves and the world we live in.

(5) And that the most cogent models are ones that deal with **universal properties**; i.e., models that may be used to understand how groups of cells work, how climate emerges, and how groups of animals in a population behavior within their changing environment. **It is important for the public to know that even given the same data, if two observers use different models, they can easily reach different conclusions.** Thus, if universally applicable models or principles are use, and if the models provide correct insight or prediction into each level, one gains confidence in the validity of the models.

(6) Control theory: It is assumed that one can do something economically, politically, environmentally, and in the use of natural resources and then determine whether the action is right or wrong. If wrong, then is possible to change policy and correct the problems. Obviously a control theory approach. However, control theory tells us that we can do such corrections if there is only a small lag between our actions and the observations of the consequences of our actions (it also assumes that we have sufficient data to make such corrections). Take Measure 5 as one example: We began with insufficient data and then proceeded on the basis that we could correct errors. However, the consequences of our actions are far removed from the time when we made the initial choice and will continue to be far removed from any corrections we make. Similar problems arise in resource management. Clearly, the models we are using (implicit or otherwise) are based on faulty data and involve extremely long time intervals between the responses we make and the consequences of our responses. Given such conditions, control theory tells us that we should observe wild, uncontrolled fluctuations in our observations (sound familiar, from the stock market to resource management?).

All of the above can be addressed in interactive graphical or physical displays.

The group also discussed a number of models systems that have greatly changed our world view. For example: Information about the movement of the earth's crust, paleontological evidence, and findings of hydrothermal vents (all involving findings obtained serendipitously) have changed our view of organisms have evolved. The effort of the discussion was to have the exhibits (graphical/animation in particular) convey the notion of data, discovery, seeking of universal properties, establishment of models, testing of models and refining or rejecting them based on tests and further data. **But particularly to use dynamical systems models that tie together all of the interests and objectives of Groups A through F. We must not present a series of unrelated thoughts--not just simply to present interesting or entertaining displays, though the displays must of course be interesting and entertaining.**

SOME SUGGESTIONS

After listening to the comments of the various Groups, the following thought came to mind that might retain the specific interests of each Group, but yet might also unify them. I'll explain the idea using the attached diagram, but the physical organization need not be as I've shown it. Moreover, I've indicated paths for each of the A-F groups, but quite likely it might be possible to merge some groups into a single display path. The following is a sample into:

"CHANGE IN OUR COMPLEX WORLD"

SAMPLE SCENARIO:

"CHANGE IN OUR COMPLEX WORLD"

Imagine entering a tunnel. As you progress slowly down its length, you will hear:

"You are about to enter into the minds of scientists studying many different aspects of our world: The crusts of the earth. The ocean and atmospheric masses. Our forests and animals. The use and management of these resources. Even the human body and its cognitive structure, the brain."

"All of these are composed of many interactive and interrelated parts: i.e., they are complex. Most importantly, they change, often in unpredictable ways."

"Scientist work to obtain data. To understand this data, they must build conceptual models. These models, in turn, affect how scientists go about collecting further data with which to test their models. The world, like our bodies, is a "black box" whose workings still elude us. For the scientist, entering this black box experimentally to understand it is an exciting, though often serendipitous journey into the unknown, full of potential errors. Since the scientist's work is biased by preconceived concepts, the most difficult job of the scientist is to determine what is actually objectively real or false in his or her model world."

"As you choose your visitation paths, you will be exposed to repeating themes of how scientists attempt to understand and to predict how change comes about and what this might mean to you. You shall eventually enter into a system of your own choosing and become a player within it. You will inquire into how you're actions affect the system you have chosen, and, in turn, how the changing system affects your subsequent actions."

"In each path you will see animated graphical displays depicting each of the areas of research, from the movement o f the earth's crusts, to the formation of ecosystems, movement of the oceans and atmospheric masses, consequences of the use and management of our natural resources, to the functioning of brain cells."

"You will then move to displays of the concepts relating universally to all o f these subjects. Here, and in a parallel path, you will enter into an interactive systems that places you into a decision making position where you actions represent policy. "

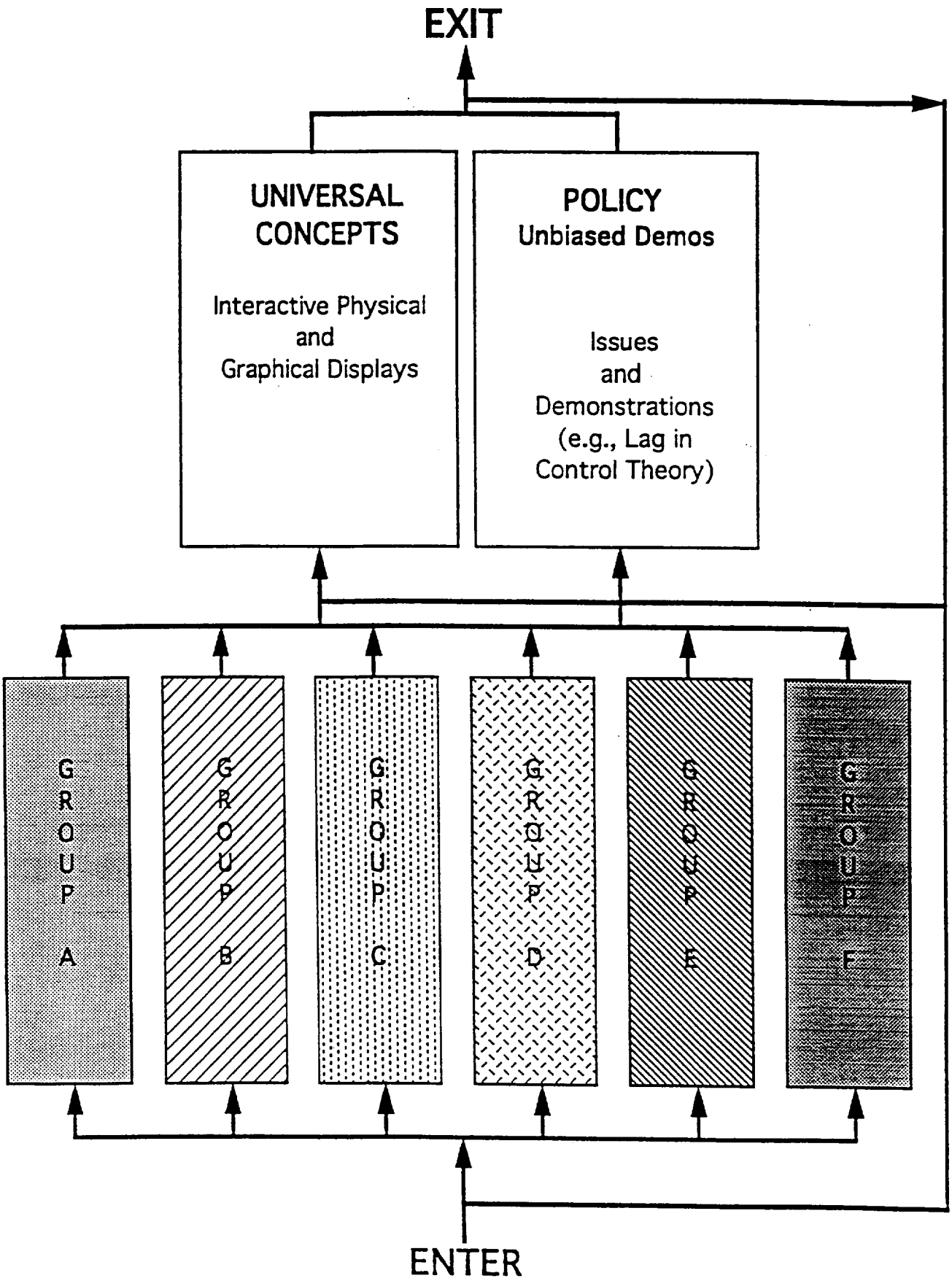
"In the universal concepts path you will experience models of the earth's crust and of the atmosphere. You will observe a real enactment in a physical display showing the atmosphere of Jupiter and the formation of a storm , Jupiter's big red spot, many times the size of the earth. You will interact with a water wheel that demonstrates perhaps the most important feature of dynamical systems, from storms to brain function, namely, the notion of change and how it happens unexpectedly in what scientists call 'bifurcation'". You will observe bifurcation in even small systems, such as the beating of the heart, in brain waves, and in the actions of single neurons. Current science tells us that they follow similar themes."

"In the Policy path you will experience the major difficulty in making decisions: The effect of lag or the time between making a decision and the consequences of that action. Over millions of years, Nature has learned to overcome this problem. Have we?"

Additional Consideration:

May wish to be sure that all paths help individuals to understand how the scientific process works and that it remains consistent and rigorous regardless of topic or discipline. Moving them through unifying principles and a final integrating policy probelm might also make sense. One might even introduce visitor to policy problem when they first walk in so that they are thinking about it as they peruse and interact with the different disciplinary and topical exhibits.

One Possible Conceptual Layout of the Exhibits



FINAL NOTE FROM GROUP F.

"I was particularly surprised to hear, from experienced people, of ideas that were designed primarily to entertain. Entertainment is indeed high on the list, but it is insufficient by itself (even if it brings in a great deal of money). In our view, it is essential that every exhibit ties in with every other exhibit. There must be an (entertaining) theme without which we will only create a carnival. Moreover, the theme must be of real substance. E.g., not simply graphical nor on the level of "isn't it interesting", nor even if each idea has scientific value. There must be an overall connectedness that is repeated in each path and further unified in the Conceptual and Policy paths. What we have tried to outline here is the notion of dynamical systems and what they have in common."

Appendix C

Hatfield Marine Science Center Visitor Questionnaire

WELCOME!!! The Hatfield Marine Science Center is planning to create new exhibits and displays. We would like your input and opinions. Please fill out both sides of this questionnaire, and feel free to include any additional comments or suggestions that you have. THANK YOU!!!

1) Why were you interested in coming to the Marine Science Center today? (check as many as you'd like)

___ To see exhibits/displays (which ones?:_____)
___ I am interested in a particular topic (what specifically?:_____)
___ To do something fun
___ To check it out/see it, generally
___ Other:_____

2) What did you expect to see and do at the Marine Science Center today?

3) Did you know that there are many scientist who do research about marine life and the marine environment at the Marine Science Center?

___ Yes ___ No ___ Unsure

4) What would you like to know about the results of research that goes on here, and about how the research is done?

5) How much would you say you know about:	A lot	Moderate	A little
-Science and how science is done?	___	___	___
-Marine life, the coast and the ocean?	___	___	___

-How have you gained this knowledge/experience?_____

6) We need help in deciding which subjects to include in future displays. On a scale of 1 to 5, how much would the following topics and types of displays be of interest to you?

	Not Interested 1	2	So So 3	Very Interested 4	5	Don't Know
Meet and talk with a marine scientist	___	___	___	___	___	___
Learn about The Scientific Method (e.g., how is science done)	___	___	___	___	___	___
How to Search for Patterns in Complexity (e.g., how we can understand complicated things in nature)	___	___	___	___	___	___
The Consequences and Uses of Research (e.g., use of research to make decisions and solve problems)	___	___	___	___	___	___
See Videos about Scientists' Work	___	___	___	___	___	___
See Live Animal Displays	___	___	___	___	___	___
Use Interactive Computers	___	___	___	___	___	___

	Not Interested 1	2	So So 3	4	Very Interested 5	Don't Know
Use Hands-on Exhibits	___	___	___	___	___	___
Research at a Global-scale (e.g., climate & weather; ocean currents; plate techtonics)	___	___	___	___	___	___
Research on a regional-scale (e.g., geographical areas)	___	___	___	___	___	___
Research on ecosystems & animals (e.g., ecosystems; interplay of different plants and animals)	___	___	___	___	___	___
Research at a Microscopic-scale (e.g., individual plants & animals as ecosystems)	___	___	___	___	___	___
Managing natural resources (e.g., interplay of economic & environmental issues)	___	___	___	___	___	___
See scientific tools and equipment	___	___	___	___	___	___
Pollution and marine animal diseases	___	___	___	___	___	___
Biodiversity & endangered species	___	___	___	___	___	___
Marine habitat loss & oil spills	___	___	___	___	___	___
Global warming & ozone depletion	___	___	___	___	___	___
Aquaculture/Fisheries & Seafood	___	___	___	___	___	___
Forest Resources & Water cycles	___	___	___	___	___	___
Nearshore & Coastal Habitats	___	___	___	___	___	___
Deep Ocean Habitats	___	___	___	___	___	___

7) Suggestions for future displays:

8) Who are you here with today:

9) Where are you from:

10) Visits to the Marine Science Center: ___ First time ___ Once or twice before ___ 1-2 times/yr ___ 3 or more times/yr

11) Today, did you go or do you plan to go to the Oregon Coast Aquarium? ___ Yes ___ No